CANADIAN ARCHITECT AND BUILDER.

VOL. IX.—NO. 10. OCTOBER, 1896 PRICE 20 CENTS $2.00 PER YEAR.

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CANADIAN ARCHITECT AND BUILDER,

A Monthly Journal of Modern Constructive Methods,

(With a Weekly Intermediate Edition—The CANADIAN CONTRACT RECORD).

PUBLISHED ON THE THIRD THURSDAY IN EACH MONTH IN THE INTEREST OF

ARCHITECTS, CIVIL AND SANITARY ENGINEERS, PLUMBERS, DECORATORS, BUILDERS, CONTRACTORS, AND MANUFACTURERS OF AND DEALERS IN BUILDING MATERIALS AND APPLIANCES.

C. H. MORTIMER, Publisher,

Confederation Life Building, - TORONTO, CANADA.

Telephone 2362.

Branch Office: NEW YORK LIFE INSURANCE BUILDING, MONTREAL.

Bell Telephone 2299.

SUBSCRIPTIONS.

The CANADIAN ARCHITECT AND BUILDER will be mailed to any address in Canada or the United States for $2.00 per year. The price to subscribers in foreign countries, is $2.50. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for, if so stipulated by the subscriber; but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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TO ADVERTISERS.

For the benefit of Advertisers, a copy of this journal is mailed each week to persons mentioned in the CONTRACT RECORD reports as intending to build, with a request to consult our advertisement pages and write advertisers for material, machinery, etc.

Trade Combines.

AN agreement has been entered into between the Granite Dealers' Association of Aberdeen, Scotland, and the Boston Wholesale Granite Dealers' Association, whereby the former binds itself not to sell to anyone in the United States who is not a member of the Boston Association, while the latter Association binds itself not to purchase granite from any person outside the membership of the Aberdeen Association. Our recollection is that there are on record instances in which the courts have compelled combines of this character to sell to outsiders who were desirous of purchasing their goods. The legal view appears to be that when an individual or a company engage in the business of publicly selling any material they are bound as far as possible to supply the public demand for such material, or at all events they have not the right to draw a distinction between the would-be purchaser who is a member of a trade organization and one who is not.

Proof of Qualification by Architects and Builders.

THE many disasters which have occurred in recent years due to the ignorance and carelessness of persons practising as designers and constructors of buildings, have in some measure directed public attention to the necessity of compelling such persons to give proof of qualification for their important duties. While the efforts put forth by the architects of the State of New York and the Province of Ontario to obtain legislation of this character, have so far failed of their purpose, it is gratifying to know that the necessity of such legislation is becoming more widely recognized, and if those who have been pressing for reform in this direction do not become weary in well doing, there is little doubt that the desired object will be attained in the near future. From the National Association of Building Inspectors convened last month at Buffalo, comes the following resolution on the subject: "That it is the opinion of the National Association of Building Inspectors that public safety demands that persons practising the profession and trade of architect, civil engineer and builder should do so under license, to the end that those who practice such responsible professions and trades should first show their fitness to do so; therefore, we recommend the passage of State laws leading to the accomplishment of this end." Building inspectors are daily brought in contact with the work of incompetent architects and builders, and have the opportunity of knowing, as few can, the danger of loss

to property owners and of health and life to the occupants of buildings erected by these classes. Consequently the pronouncement which has just been made by their association should receive proper consideration from the public and more particularly from the governing bodies.

The A. I. A. THE American Institute of Architects will hold its thirteenth annual convention at Nashville, Tenn., on the 20th, 21st and 22nd inst. A discussion has been arranged for at this convention, on "The Influence of Iron and Steel Construction and of Plate Glass on the Development of Modern Style."

Water Flush and Diameters of Drains. THE Northern Architectural Association in conjunction with officials of the Newcastle and Gateshead Water Company recently made a number of experiments for the purpose of ascertaining the quantity of water required to properly flush a water closet and connecting drains. Also the diameter of drain necessary to insure proper cleansing. These experiments are said to have demonstrated the fact that with proper closets and fittings two gallons of water are sufficient for flushing purposes in dwellings, and that a four inch drain was more perfectly cleansed than a six inch one, notwithstanding that the former contained a more acute bend and was laid at a less steep gradient than the latter. In the principal cities of Canada the use of cast iron pipe for house drains has very properly been made compulsory, and in corroboration of the results of the above mentioned experiments, experience has shown that the most satisfactory results are secured by the use of four inch soil pipe in preference to pipe of larger diameter.

The Location of the Kitchen. WHAT has become of the idea so prevalent among architects a few years ago, that the top of the house and not the ground floor is the proper location for the kitchen? We recollect how convincingly a Hamilton architect talked on this subject two or three years ago, but we have yet to hear of an instance in which he has put his ideas in practice. The main argument in favor of changing the location of the kitchen in the manner suggested was, that the kitchen odours would find an immediate outlet into the atmosphere instead of being confined and diffused throughout the house. It is to our mind at least a matter of doubt whether the proposed change would secure this desirable result. We know of an office building in which the odor of the cooking from the caretaker's kitchen on the sixth floor at times assails the nostrils of the occupants on every floor, even to the basement. We should be pleased to receive from some of the advocates of the elevated kitchen an explanation regarding this conspicuous failure of their theory.

The P. Q. A. A. WE print in this number an account of the proceedings in connection with the recent annual convention of the Province of Quebec Association of Architects. A perusal of the annual report of the Council shows that an earnest effort has been made during the year by the management of the Association to accomplish a number of very desirable objects. It is to be regretted that in some directions the results achieved have been small owing to failure to get a sufficiently large attendance of the members at the meetings. The enthusiasm which has prompted a few of the leading spirits to stand by the work of the Association in the face of these and other discouragements is highly commendable, and we trust will prove an inspiration to others to give more of their thought and time to the promotion of the Association's welfare. In spite of difficulties the Association has already accomplished a useful work, and has abundantly justified its existence. A much greater work lies before it in the future, and this also will be achieved if every member would feel his individual responsibility to give what assistance is in his power. The establishment of a chair of architecture in McGill University is doubtless in a measure an outcome of the efforts of the Association on behalf of the proper education of future generations of architects, and conversely the Association should derive assistance and support from this department of the university. The City Council of Montreal has shown itself to be alike deficient in gratitude and appreciation of what is due the interests of the citizens, by neglecting to take action upon the recommendations submitted by the Association for the improvement of the building by-laws of the city. A committee of the Association spent months of earnest effort for this object, and it will be a lasting disgrace to the Council if this effort is not recognized and proper consideration given to the recommendations which have been submitted. This statement equally applies to the City Council of Toronto, which is making no effort in the direction of approving or disapproving of the recommendations of the Ontario Association of Architects for the amendment of the city building ordinance. Such treatment is but a poor reward for disinterested efforts in behalf of the public welfare. In connection with the recent convention of the Quebec Association, we miss the papers and discussions on architectural subjects which have usually formed an interesting and instructive feature on similar occasions in the past. Considerable effort and self-sacrifice are certainly involved in the preparation of such papers, but a corresponding benefit is derived by those who hear and read them as well as by the authors themselves from the necessarily thorough study of their subjects. We therefore hope to see this valuable feature re-introduced in the annual conventions of the Association in the future. The Arts and Crafts Exhibition proved an extremely valuable adjunct to the convention, and is well calculated to give public prominence to the Association and its work. There was manifested at the convention a strong desire for the formation of a Dominion Association of Architects. Such an Association, if properly organized and supported should be able to promote in many ways the interests of architecture in the Dominion. In view, however, of the difficulty which is experienced in maintaining the interest of the members in the work of the Provincial Associations we are disposed to doubt the success of a larger organization, the members of which would be scattered from one end of the country to the other. The obvious difficulties in the path of such an organization should be fairly faced and considered before any definite action is taken. If the architects throughout the Dominion would express through our columns their views on the subject, the probable success of the movement could be more easily estimated.

BY THE WAY.

A CERTAIN well-known firm whose business it is to manufacture and install heating apparatus were recently advised that one of their plants was not doing satisfactory work. Without showing the least surprise at the information the member of the firm to whom it was addressed, replied in terms like these : "Oh, well, that house was put up by So-and-So, and the heating system is not by any means a fair example of our work. You see, the price was so cut down that it simply was not possible to give the work proper attention." Here we see the evil results of trying to get work done too cheap. The man for whom the system was installed is no longer the owner of the house—in fact he "went down" with many others in the crash which followed the Toronto real estate boom. The present owner in purchasing took it for granted that the heating system was all right because the firm who installed it have a first-class reputation. Aside from the disappointment and discomfort experienced by him as the result of finding that the system is not up to the expected standard, was it wise on the part of the heating contractors to tender at a price which made it impossible for them to do the work properly and maintain their reputation? I have no hesitation in expressing the opinion that it was not, as one such imperfect job is likely to result in future losses exceeding many times in amount the paltry profit which they may have succeeded in squeezing out of the contract.

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"THERE are about half a dozen persons who are not getting their usual amount of sleep these days on account of the contract for heating the new city and county buildings," said a member of a well-known Toronto firm of heating contractors to me the other day. Then he went on to tell me who these persons were, and how the different manufacturers of radiators were working tooth and nail to guide the contract into the hands of their friends who might be depended on to purchase from them the required radiators. My informant remarked that the condition in the specifications requiring that tenderers must show that they have successfully carried out previous contracts of corresponding magnitude, and that they are in a position financially to carry out the work, would be sufficient to narrow the competition down to half a dozen firms at most. "It is a foregone conclusion," said this gentleman, "that the contract will be taken at a low figure, but I think that in view of the many risks involved in a contract of such magnitude, the contractors who successfully complete the work, are entitled and should certainly receive a substantial profit." In answer to my enquiry he expressed the opinion that the work could only be successfully carried out by placing the entire contract in the hands of one firm, and resting the responsibility entirely upon their shoulders. Any attempt at sub-contracting would be sure to lead to confusion and trouble. As an instance of the risk involved in large contracts of this character, my attention was called to the fact that the disagreement into which Mr. Neelon, the contractor for the masonry of this building, fell with the architect, and the extended litigation arising therefrom had caused the contractor's ruin, and that Messrs. Brown & Love, one of the most honorable contracting firms in the Dominion, had suffered the loss of thousands of dollars as the result of their effort to be released from their tender for the completion of the work. "There will be required for this contract," said my friend, "a large number of American specialties, for which 'cash down' must be paid, while the contractor will perhaps be required to wait a long period for payment of his accounts under the contract. He must therefore have a long bank account, and should, as I have already stated, reap a liberal margin of profit from the undertaking." It is understood that the architect has estimated the cost of the heating system for the building at $100,000.

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IT is by no means an unusual experience to meet with men who cherish original notions regarding the kind of house they would like to build for their comfort. It is well that in the majority of instances these notions never get beyond the form of "castles in the air," for if put in concrete shape the inventor would quickly be disillusionized. If we are to believe a writer in Truth, however, one such individual who happened to be blest with an abundance of "the needful," not only conceived but carried out a decidedly novel idea of house building. We are told that "this man, who has a large lake upon his estate, recently caused it to be drained, and in the deepest part he has had a house built which contains three rooms—a smoking-room, a dining room, and a servant's waiting-room. The frame-work of the house is of iron, and the floor is stone resting upon a foundation of concrete. The sides and the roof, however, are entirely composed of very thick plate glass. There is a passage under the water from the boathouse to the glass house, and air is obtained through large clumps of artificial water-lilies which rest upon the surface of the lake. It is indescribably pleasant to sit in one of the rooms upon a warm day ; the air is very cool, there is no sound to be heard, and it is especially interesting to watch the fish swimming round, attracted by the glare of the electric lights. This is decidedly a new luxury. The house and the passage, moreover, cost comparatively little to build." If the statement that a house walled and roofed with plate glass, resting on a foundation of concrete and with subaquæous passages, was constructed at comparatively little cost was meant to be taken seriously, we have another proof of the adage, that "Truth is stranger than fiction."

STRENGTH OF GIRDERS.

THE Effective Span, for computing the strength of a girder, says the Contract Journal, is the distance between the centres of the bearing areas which support the ends of the girder. The span is usually measured in feet and inches in practice, but for use in computation it is either in feet or parts of a foot, or all in inches. This is according to the nature of the expression (or coefficients) in the formula, as it requires all dimensions $\left(\frac{b\,d^2}{l}\right)$ to be in the same denomination—b, d, l denote the breadth, depth, and length respectively.

As the weight of the girder itself forms a part of its load, hence only the weight per foot run of the clear span between the supports should be taken. The weight of the girder is treated as a uniformly distributed load, and is double that of a centre load.

In computations for obtaining the stiffness of girders, the length of the span and the deflections must be taken as those of the clear span only between supports, and not to the centres of the bearing areas, as required for computations of the strength of girders.

LOADS AND STRENGTH OF ROOFS.

In making estimates of the weights of roofs it is essential that external appendages, such as lantern lights, ventilators, etc., should all be included, as well as ceilings, attic floors, water-tank and water, and any quantity of fixtures, furniture and storage liable to be sustained by the roof supports. All articles and details of the roof structure and the external and internal appendages should be estimated at their maximum weights, so that the gross estimate shall cover all probable strain-producing loads that are likely to be encountered in the use of the building. In addition to these dead loads there should, in the case of occupied attics, be an allowance for the live load of occupants. This allowance may be somewhat less than the usual allowance of 1¼cwt. for the ordinary floors of dwellings per square foot of their area, as the probability of its containing a moving crowd would be very remote. Probably a ½cwt. to ¾cwt. per square foot would be a sufficient allowance to make for this purpose to include ordinary furniture, but would be exclusive of the weight of the flooring joists, plastered ceiling, etc. The weight of a full water-tank of 2ft. 7in. height of galvanized iron with fittings would be about 2¼cwt. to 2½cwt. per square foot of bottom area, the weight of water being 10lb. per imperial gallon, and there being about 6¼ gallons in a cubic foot. The weight of single ceiling joists of dry fir to sustain attic floor, together with flooring boards, may range from 9lb. to 12lb. per superficial foot; lath and plaster ceiling—two coats 9lb., three coats 10lb. per foot super; ceiling joists for counter ceiling adds 2¼lb. to 2½lb. per square foot. The weight of roof trusses varies with span and pitch, the spacing apart, and the kinds of materials used in the construction. Approximate weights may be obtained by reducing it to the horizontal projection of the floor area covered by the roof, and then multiply a unit area as a square foot by the weight of the horizontal projection of the portion of the roof supported by the truss—i.e., the bay or the space between the centres of two adjacent trusses. On this basis an average may be arrived at for the ordinary pitch of one-quarter span, using a king-post truss, say, up to 35ft. span, and for larger spans a queen-post truss. The weight of a dry fir truss complete, including tie-beam, for 20ft. span will be 1¼lb. per square foot of floor area covered by the half of its bay on each side of it; 30ft. span, 1 9-10lb.; 40 ft. span, 2⅛lb.; 50ft. span, 2 3-5lb.; 60ft. span, 3⅛lb.; 70ft. span, 3 4-5lb.; 80ft. span, 4⅓lb.; 90ft. span, 4 4-5lb.; 100ft. span, 5⅓lb.; for each additional 10ft. of span add ½lb. For intermediate spans interpolate the corresponding proportion of the difference for the spans adjacent to it.

The purlins, ridge board, and ridge roll add 2lb. to 2½lb. per square foot of floor area covered by roof. Common rafters add about 3⅓lb. to 3 2-5lb. per foot super of floor area covered; sheating of 1in. thick boards of fir, spruce, or pine (white) 3lb. to 3½lb. per square foot of roof surface; Georgia pine, oak, ash, 5lb. per square foot. The weight of the external covering adds as follows: lead, 6cwt. to 8 cwt. per square of 100 square feet; slating laid with 3in. lap, including nails, but not battens or iron laths, for doubles 13in. by 9in. and ladies 16in. by 8 in., 8¼lb. per square foot of roof surface; countesses, 20in. by 10in., 8lb.; duchesses, 24in. by 12in., 8½lb.; tiles, 11in. by 7in., plain, with 3in. lap, mortar pointing, including laths and absorbed damp, 18lb. per square foot; pantiles, 13½in. by 9½in., including same as plain tiles, 12lb.; Italian, ridge, and furrow tiles, including pointing and damp, 14lb.; slate battens, 3½in. by 1in., for doubles, 2lb.; for countesses, 1¼lb.; zinc roofing, 14 to 16 zinc gauge, 1½lb. to 1¾lb.; galvanised iron, corrugated, 16 wire gauge, 3½lb.; 18 wire gauge, 2½lb.; 20 wire gauge, 2lb.; sheet iron, 16 wire gauge, 2½lb.; 20 wire gauge, 1½lb.; thatch, including battens, 6½lb. From the foregoing data, approximate weights of roofs can be estimated, making allowance for increase of length of rafters over the span for other roof pitches; thus if the value of the half span be 1, then the length of the rafter for quarter pitch is 1·12, for one-third span pitch 1·2, for three-sevenths span pitch 1·32, for half-span pitch 1.414. These weights of the roof, together with the weight of all appendages, all act in a vertical direction. An allowance for the weight of accumulation of snow is also made, say 5lb. per square foot of floor area covered by roof is considered sufficient for this country. In America this same allowance is made for localities such as St. Louis, Richmond, Louisville (Ky.) in north latitude about 37½deg. to 38deg.; 10lb. is allowed in Baltimore, Cincinnati, and Indianapolis; 15lb. is allowed in Philadelphia, Pittsburg, and Wheeling; 20lb. in New York City, Cleveland, Chicago, Des Moines; 25lb. in Boston, Albany, Buffalo, Milwaukee, St. Paul; 30lb. in Northern New England and New York States, Michigan and Minnesota. Some writers have suggested that the allowance for the stress produced on a roof normally to the inclination of its pitch by wind pressure of the maximum force used in practice, would sufficiently cover the allowance for snow, as before such a maximum wind force could take effect upon the windward side of the roof all the snow would have been blown off it, and hence the allowance for snow according to this suggestion need not be made, except for very cold climates. The suggestion, however, could not apply to flat roofs, "well roofs," and such as are completely sheltered by solid parapets or otherwise protected from the force of the wind. It may be observed that in cold countries the snow is generally frozen into solid ice on sides of roofs to which the sun rays have direct access. The direct stresses on the roof, therefore are distinguished as (1) the permanent loads, estimated on the basis just detailed; (2) the accidental loads—(a) as snow, and (b) wind pressure. These pressures should all be determined separately, and then any combination of them which produces the greatest sum of stresses affecting any member of the truss should the stress value to be adopted in estimating the strength and stiffness of each member thereby affected. The same principle will likewise apply to the stresses produced on the resisting planes of all joints and joint articulated connections with the truss members.

The weight of the roofing material, or the external covering of slates, tiles, etc., as well as that of the snow and the wind pressure direct or reversed, is sustained by the common rafters in the first instance. It is by them transmitted to the purlins which support the common rafters at intermediate points, their ends being supported respectively by the ridge piece or purlin, and by the wall plate. It is usual to divide the external and structural loads, acting upon the common rafters, equally between the points of support, so that each intermediate point shall have double that at each end. Such a distribution, however, assumes that the common rafters

are cut through over each purlin, so that they would thus act as separate beams. But as the common rafters are not thus usually cut through over the purlins, but are continuous, having proportional cantilever reactions over each intermediate support up to the points of contraflexure, the position of the points of contraflexure or their distance from the supporting intermediate purlins, and the value of the bending moments and moments of flexure, depends on the depth of the rafter or continuous beam, the distribution of the load, elasticity of the material, etc. The formulæ for thus obtaining the distribution of the load over the various purlins are complicated and need not be given here, as they have been calculated for the usual scantlings of common rafters of fir. The proportions of the distribution here to follow are based on a continuous uniform cross-section of straight rafter, supporting a uniformly distributed load. The points of support are equidistant from one another, and their bearing surfaces all in the same straight line. The loads for the two halves of the spans continuous over several supporting purlins are alike; it is therefore only necessary to give the lowest or eave half of the continuous rafter supports. When the number of spans is odd the number of supports is even, and there is no centre support. But when the number of spans is even and the number of supports odd, the centre support is the turning point of the values of the purlin loads for both halves. Thus when there are two spans and three supports the wall plate and the ridge pieces each bears 3/8 of the load upon their respective spans, and the purlin bears 10-8 of a similar load. When there are three spans and four supports, the eave and ridge piece each bear 4-10 of the single-span load, and the two intermediate purlins each bear 11-10 of the same load. Similarly, when there are four spans and five supports, the wall plate and ridge bear 11-28 of single-span load, the second and fourth supports bear each 32-28, and the third or middle purlin bears 26-28 of the single-span load. For five spans with six supports, the wall plate and the ridge each bears 15-38, the first and fourth purlins 43-38 each, the second and third purlins each 37-38 of load.

The practical difference that this ratio of distribution of the loads over the rafters, and consequently over the purlins, will affect roofs of large span and having the trusses set a considerable distance apart—say, upwards of 12ft. or 14ft. In such cases the scantlings of the purlins would require to be proportioned for the increased ratio of load. In ordinary roof timbering the scantlings of the purlins would all be alike, but in such case they should have sufficient strength for the maximum apportionment of load. Taking as an example the case of two spans and three supports, the difference in the load on the purlin between treating the rafters as two separate beams and one continuous beam is that in the former the purlin would only bear half of the entire load on the rafter, whereas as a continuous beam it bears five-eighths of the entire load. The excess of load as a continuous beam imposed upon the purlin is thus one-eighth of the entire rafter load for the whole span of the purlin. If the span of the purlin be 14ft. between the spacing of the trusses and that the purlin was placed 8ft. from the wall plate, the load area of roofing supported by it would be 112 square feet. Then suppose the permanent load on the purlin, including its own weight, all uniformly distributed, were 26lb. per foot super for plain tiles, the total would be 2,912lb., or, say, 3,000lb. in round numbers. The excess of one-eighth of the entire load or one-quarter of the above, half-rafter load would be 750lb., and if the wind load were, say, three-fourths of the above say 563lb., the total load would be 1,313lb. This proportionate excess in such a case as assumed, would be a sufficiently large excess to require a special computation of the strength of the purlin so as to be safe against bending under it on the occurrence of a storm of wind.—The Contract Journal.

VENTILATING AND WARMING STABLES.

BEFORE considering the ventilation, it will be well to see what is a proper and sufficient area of floor space for stables and loose boxes, and also the cubic space that should be given for each horse.

In practice the sizes of stalls and loose boxes vary according to the space at command, without in most cases any reference to sanitary considerations, but a good standard size for a stall is 6 ft. wide by 9 ft. long, from the wall to outside of stall post; if they are wider than 6 feet the horse has too much room and can turn around in the stall, while if longer than 9 feet the horse is dwarfed in appearance.

The gangway at the end of the stalls should not be less than 6 feet wide in a stable with stalls on one side only.

The size of loose boxes is not affected in the same manner, and very good dimensions for a loose box are 12 feet long by 12 feet wide; but it should not, unless under very exceptional circumstances, be less than 10 feet by 9 feet, and the gangway should be 6 feet wide, whether the boxes are along one only or both sides of the stable, and the doors should open outwards.

Taking the above as standard sizes we get the floor areas as under:

For a stable with stalls on one side, 90 square feet per horse.

For a stable with stalls on both sides, 81 square feet per horse.

For loose boxes on one side only, 216 square feet per horse.

For loose boxes on both sides, 180 square feet per horse.

The cubic space to be allowed to each horse varies according to different authorities from 900 to 1,600 cubic feet for an ordinary size animal. Hutton gives 1,560 cubic feet as necessary. We should say that it should not be less than 1,500 cubic feet, which is one and a half times that laid down by the best authorities as requisite for a healthy sleeping apartment for a human being; and we may, we think, safely assume that this proportion will not be excessive for an animal like a horse, considering the exhalations that must arise from soiled litter, etc.

This capacity, taken with the floor areas already given, gives a height of 16 feet for a stall stable with one row of stalls, 20 feet for a stable with two rows, and about 9 feet for loose boxes.

It will be at once recognised that while the floor area actually given does not in most cases vary very much from our standard, the cubic capacity is seldom given except in some high class hunting and other stables in the country, and never in London, where it is very uncommon to find a stall stable having more than 1,000 cubic feet per horse, and that insufficiently ventilated.

The following examples are from stables in existence.

Unfortunately the cubic space is not so complete as we should wish it. We have not had time to supplement it, but those examples we have taken will be recognised as good ones.

	Floor area	Cubic space per horse.
Gifford Hall Stables, stall	120	1680
" " loose boxes	216	3020
Wretham Hall, loose boxes	185	
Frognall, Kent, stalls	134	
Moreton Hall, stalls.......	126	
" " loose boxes.......	216	
Cowesfield House, stalls........	120	1080
" " loose boxes ...	210	3780
Easton Park, Suffolk, stalls......	105	
" " " loose boxes	150	
Lock Inch Castle, stalls	130	
" " " loose boxes ...	195 to 250	
Claremont House, stalls	130	
Copse Hill Hunting Stables, stalls	130	
Ditto loose boxes	186	
Berkswell Hall, stalls	128	
" " loose boxes	190	
Havering atte Bowe, stalls.......	147	
" " " loose stalls..	120	
Private Stables at Brighton, stalls	95	
Ditto loose boxes	193	
Private Stables in London, stalls	84	798
Ditto loose boxes	100	950

From these examples it will be seen that, even in superior town stables, the cubic capacity is actually below that required for the human being.

In the country stables, the floor spaces are in nearly all cases equal to or more than our standard, while the cubic space is considerably more in the case of loose boxes, showing that the amounts we give as standards are generally recognized as being necessary for a really good stable.

In the following remarks we shall therefore assume the cubic space to be dealt with as 1,500 cubic feet per horse, and the average height of the stable as 15 feet; and with this explanation our readers will be able to correct the quantities hereafter given to suit other capacities.

The next step is to decide what quantity of fresh air is required to be admitted in summer and winter; but as in summer the extra quantity required can be easily supplied by opening the windows, which must be provided for lighting (for it must not be forgotten that light is as necessary as air to maintain a healthy state of body, whether in man or horse) it will be sufficient to consider what ventilation is required in the winter only.

Dr. Parkes, in his well-known work on Hygiene, says we should allow 6 cubic feet of fresh air per minute for a man; M. Peclet and Mr. Hood give from 3½ to 5 cubic feet of fresh air per minute, as the minimum quantity that should under ordinary circumstances be allowed for a human being in the winter to maintain the wholesomeness and purity of the apartment; and it seems reasonable to assume that a horse would require at least half as much again, or say, 7½ cubic feet per minute in the winter, and double that in the summer, and a further allowance must be made on account of the exhalations from soiled litter, etc.

The size of the inlet ventilators should, according to Dr. Parkes, be 24 square inches per man, and the Commissioners on improving the sanitary condition of Barracks, etc., laid down 1 square inch for every 60 cubic feet capacity, which, on 1,500 cubic feet gives an area of 25 square inches—we, have, however, considered that a horse requires 1½ times the space, and consequently the air, that a man wants, and therefore the area for each horse should be 37 square inches, which, allowing the maximum velocity that can be permitted without causing a draught, viz., 3 feet per second, gives an admission of 46 cubic feet per minute, equivalent to changing the whole air of the stable twice in each hour.

This quantity of air will be delivered when there is a difference of 10 deg. between the outside and inside temperatures.

There must, however, not only be inlet ventilators for the admission of fresh air, but outlet ventilators for the escape of the vitiated air, and, quoting Mr. Hood, "it is advisable to make the aggregate area of the openings that admit the fresh air larger than the aggregate openings for the efflux of the vitiated air. This becomes necessary notwithstanding the increase of volume which takes place in the heated and vitiated air."

If the opposite course be adopted, and the outlets be larger than the inlets, then a counter-current takes place, and the cold air descends through the outlet tubes unless prevented by some special means, and by making the inlet of large area the velocity of the incoming current is reduced, and unpleasant draughts avoided.

It is also expedient to divide the entering current as much as possible, for by so doing the dangerous effects of cold draughts are prevented when the entering current is colder than the air of the room; and when it is hotter, it prevents the air from rising too rapidly towards the ceiling and therefore distributes it more equally through the apartment.

Provided the aggregate openings for the admission of cold air be not less in size than those for the emission of the heated air, the quantity of air which enters depends less upon the size or number of the openings which admit the fresh air, than upon the size of those by which the vitiated air is carried off.

We have now arrived at this result, that for each horse we require 37 square inches of inlet valve area, while the outlet area must be less; say 20 or 30 square inches per horse.

Outlet valves should either be taken into chimney flues or into special shafts made for the purpose, and carried up as high as possible above the ceiling of the stable. The valves themselves should be placed close up to the ceiling.

Everyone with a knowledge of stable matters knows that there is more or less stagnation of air at the head of a stall, closed in as it is on three sides, and with the manger plate projecting some 15 to 18 inches into the stall at a height of about three feet above the floor, thus forming a kind of open box; also in a range of loose boxes where the only air that gets into the bottom of the boxes is what finds its way under the doors, which are often kept an inch or two off the floor for the purpose. Attempts to remedy this have been made by keeping the sills of stalls and loose boxes an inch or two off the floor, with the result that a space was left in which horses were liable to catch their feet, and which it was difficult to get under to clean.

The new arrangement consists of a new form of sill, of girder shape, having the webb connecting the upper and lower flanges perforated with holes. The bottom flange is made flat to rest on the floor, with caulkings going into the floor to secure it laterally. The top flange is made with a groove to take the woodwork, which is thus kept well above the floor and away from all damp. At the head of the stall or loose box an iron-plate takes the place of part of the woodwork, and below the level of the manger plate, this is perforated in a similar manner to the sill, so that the air can circulate

freely from stall to stall, or box to box, throughout the length of the stable. The section of the sill is such that there are no corners in which dust can accumulate, and it can readily be swept or washed clean by a broom, and there are no projections or corners against which a horse can injure himself.

We have given the areas of inlets and outlets for what we consider sufficient ventilation for the winter, but this must be supplemented in summer, as already mentioned, by windows. There is no doubt that a stable, to be healthy, should also be light, and where possible overhead skylights should be given ; but in the majority of cases this is impossible, and we should then advocate glazed hopper or swing windows above each stall or loose box, and where there is only one row of stalls or boxes, ordinary sliding windows on the gang-way side opening top and bottom with their sills not less than 5 feet above the floor.

The actual area of windows required varies, according to different authors, from 1 to 10 square feet for each cubic feet of space. It may therefore be assumed that it should not be less than fifteen square feet for each horse, more being given according as the light is obstructed by other buildings, etc., in close proximity.

This article has now extended to such a length that we have small space for any remarks on warming. It must therefore suffice to say that 5 square feet of hot water pipe heating surface per 1,000 cubic feet of space, or 7½ square feet per horse, should be sufficient ; and hot water coils should if possible be placed in the space beneath a window and so protected that there may be no projections against which a horse could injure himself when passing.

MARBLE IN INTERIOR WORK.*

Now, when we come to interior work, a new field is open to us. We are not bound by influences such as those that have been under our consideration. What we have to consider primarily is strength of material for its purpose ; secondly, its adaptability ; thirdly, and generally to the client the most important, its appearance when finished. With all due respect to your president's opinions, I, if I followed my own inclinations, should give marble the premier place as an internal material. Doubtless a number would say that marble is out of the question for general purposes, its cost is so great ; but marble does not itself ask for treatment such as you give to stone. Work executed in marble can and should be finished so as not to have any appearance of grimness or even of dinginess.

Marble should not be looked upon as a constructional, but rather as a decorative material ; and, looking at its use from a monetary point of view, I would quote Mr. W. Brindley's paper before the Royal Institute of British Architects some two or three years back, where he tell us that "at St. Sophia 2,000 feet super of delightful decoration of a durable character was cut out of a single block of Cipollina marble, the whole opened out and making a continuous pattern." The small slab we have here is of the same material, and is a scale pattern of the pavement in St. Mark's, Venice. Then, again, to adapt marble to concave or convex surfaces, I would ask you to visit the church lately erected by Dr. Freshfield at Lower Kingswood. You will find that we have followed out the scheme of the Byzantines, viz., forming the convex face of the apse with a series of narrow slabs opened out chevron fashion, thus producing a curtain-like appearance, which has a very pleasing effect. To save such work as this—in fact, all slab work—from having the appearance we find in some churches, and what your president rightly deprecates, several things have to be considered. For instance, if the walls are built of mortar, the sand of which is Thames sand, so-called ; but if that sand comes from the mouth of the Thames, that constitutes sea sand. Consequently you will get that dampness and efflorescenee that is usual with that kind of mortar ; the walls being "cased" with marble, the salt naturally finds its way through. Marble should never be fixed solidly to the wall, but left hollow, and also with a joint here and there left open to allow for the condensation that invariably takes place. The work should be well cramped to the wall with copper cramps. The best of plaster should be used in fixing, and I have no hesitation in saying that if slab work is fixed under these conditions, and with a care in selecting suitable marbles, you will get satisfactory work, as shown by the slab work at the vestibule of the Athenæum Club, National Gallery, and other places I could mention. These buildings were all in a proper state to receive marble. Then, again, as to keeping the work clean after it is fixed. All that is required is proper attention with dry dusters. Marble work should never be washed down as you wash tiles. The dust that clings to anything damp, if rubbed constantly on the polished surface, is literally ground into the face of the marble. This applies more especially to the light marble. But if a perfectly dry dusting is given to your work I venture to say that the result will be satisfactory. These may seem very ordinary remarks and may weary my hearers, but they are of great importance if you want satisfactory results.

The mason is a methodical man. If he works a moulding—say a cornice, for instance, or a string mould—he would proceed by applying his section to chamfers and then working his chamfers through. Now, in designing your moulding this should be taken into consideration, as moulding drawn to suit the method of working seems to me to be only right, and in support of this I would ask you to examine the old specimens that are here, and also the diagram.

Work drawn on these lines, especially in marble, lessens the cost of labor considerably, the mason being able to get at it much better than if at the outset you upset his method of working. You will also observe that marble moulding drawn on these lines can be got out of these slabs and made out with a core of stone, thus giving you in effect solid cornices, etc. In drawing your sections for marble it is very essential that you should have a knowledge of the material and its capabilities of receiving mouldings. The composition of the various kinds varies to such an extent that a moulding that could be worked in one marble would be quite out of the question iu another. For instance, take a chimney piece in statuary or Pavonazza, and then one in the Cipollina or Rouge Etrusque. What could be produced in the former materials would be quite out of the question in the latter. Speaking generally, the rich colored marbles do not ask for an elaborate treatment in the way of mouldings ; in fact, the different colors, lines and markings of the material are very apt to upset the arrangement of mouldings unless they are treated in a broad manner. The use of machinery has considerably reduced the cost of marble work in England during the past few years, and also the time taken in production. The use of marble by the architects during this revival, may I call it, has been very great, and I believe will be greater in the future, when its adaptabilities are more widely and better known.

* From a paper read by Mr. Hervey Flint before the Architectural Association, London.

HAMILTON ART SCHOOL.

The annual meeting of the above school was held on the 14th of September, Rev. Dr. Lyle occupying the chair in the absence of the president. The report of the principal, Mr. Ireland, stated that during the year 54 students were enrolled, and that the school was making satisfactory progress. The receipts of the year were shown by the secretary's report to be $3,522.01, which, with a balance of $102.15 from last year, made a total of $3,624.16. The expenditures amounted to $3,450.54.

The following were appointed the committee on examinations for 1896-7 : John Knox, Thos. Beasley, F. W. Watkins, J. T. Barnard, G. H. Bisby, W. D. Long, J. J. Mason, A. O'Heir, F. B. Greening, J. Pottinger, Dr. Gaviller.

The government medals and certificates and the local prizes were given out. The following awards were announced :

Architectural perspective—No prize given for lack of funds ; Herbert H. New, 1st hon. men. ; no 2nd and 3rd ; hon. mentions given to increase value of 1st.

Architectural design—Harold H. Mundy, winner ; H. G. Batton, 1st hon. ment. ; Herbert G. Mason 2nd, and P. Stewart 3rd.

Drawing from the antique, full figure—Walter R. Duff, winner ; Mabel S. Ireland, 1st hon. men. ; Jessie Kellar 2nd, K. Saunders 3rd.

Pen and wash drawing for illustrating—Marion E. Mattice, winner ; C. Locke, 1st hon. men. ; A. N. Browne 2nd.

Building construction—Andrew P. Stewart, winner ; Ralph Mason, 1st hon. men.

Design for tiles and glass—No prize given for lack of funds ; Ben Kilvert, 1st hon. men. ; no 2nd and 3rd hon. mentions given to increase value of 1st.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.

PROCEEDINGS OF THE RECENT ANNUAL CONVENTION AT MONTREAL.

THE Province of Quebec Association of Architects met in annual session on Thursday the 8th inst., at 10 a.m., in their rooms, New York Life Building, Montreal, the President, Mr. A. C. Hutchison, in the chair. Among those present were: Messrs. A. C. Hutchison, President; A. T. Taylor, 1st Vice President; J. F. Peachy, 2nd Vice President; Jos. Venne, Secretary; Jos. Perrault, Treasurer; A. H. Lapierre, Theodore Daoust, Robert Findlay, J. Z. Resther, Councillors; H. C. Nelson, W. E. Doran, A. G. Fowler, Maurice Perrault, J. R. Gardiner, J. W. Hopkins, Simon Lesage, E. Mann, E. Maxwell, G. A. Monette, P. A. R. Labelle, James Nelson, Alphonse Raza, L. Z. Gauthier and James Wright of Montreal; Chs. Baillarge, J. F. Peachy, F. X. Berlinguet and G. E. Tanguay, of Quebec.

Letters of regret were read from different members.

In a brief address the President called the convention to order.

Reports of the Treasurer and Auditors were received and adopted, also the report of the Council which was as follows:

REPORT OF COUNCIL.

The fifth annual meeting of the Association held in the city of Quebec in October, 1895, was well attended, and the Council takes this opportunity of acknowledging the generous reception tendered the Council and members from Montreal who attended that meeting by their confreres in Quebec, and to testify to the interest taken in the Association by the members resident in Quebec.

Many items of interest to the Association were discussed at that meeting, and the following were referred to the Council for its consideration:—

First: The holding of an exhibition of architectural drawings on the occasion of the annual meeting in 1896.

Second: The preparation of a schedule of professional charges for the use of members.

Third: The preparation of conditions to be observed in competition for public buildings.

Fourth: To prepare a standard form of contract.

The Council regrets that owing to the difficulty in obtaining a quorum of its members many meetings could not be held, and it was unable to accomplish all the work allotted to it; they, however, present this report of the work they were able to accomplish.

EXHIBITION.—Early in the summer it was decided to give effect to the resolution of the Association to hold an exhibition of architectural drawings, and it was resolved that the scope of the exhibition should be widened so as to include modern artistic work applicable to architecture, and a loan collection of antiques.

The preparation for this exhibition has, during the last three months, occupied most of the time of the Council and of members of the Association whom they associated with them to assist in making the necessary arrangements.

As the funds of the Association could not be drawn upon to meet the expense of such an exhibition a number of the members have subscribed to a guarantee fund which it is hoped will defray the cost.

The Council leave to the members to judge, when the exhibition is opened this evening, as to whether it is a success or not, bearing in mind that most of the drawings are the individual work of the members, and if the exhibition is successful the Association as a whole will benefit by it.

The Council would gratefully acknowledge the help extended to it by the Art Association of Montreal in promoting and carrying out the exhibition, and in placing their galleries at our disposal. Without the assistance thus rendered it would have been impossible for your Council to have carried out such an undertaking.

SCHEDULE OF CHARGES.—The schedule of professional charges has been prepared and is now in the hands of the printer and copies will be mailed to members in a few days. The procuring of the signatures caused considerable delay in its preparation.

COMPETITION FOR PUBLIC BUILDINGS.—The preparation of conditions to govern members in competition for public buildings received but slight consideration owing to the difficulty in obtaining meetings of the Council and to the political events during the year which prevented securing the co-operation of public officials.

ASSOCIATION COMPETITIONS.—At the request of the Editor of the CANADIAN ARCHITECT AND BUILDER the Council named a standing committee consisting of the president, vice-presidents and secretary during their term of office to whom all competitions under the auspices of the Association or of the CANADIAN ARCHITECT AND BUILDER will be submitted.

STUDENTS' ASSOCIATION.—The students connected with the Association formed themselves into an organization for the advancement of their interests and for mutual improvement in their studies. With a view to promote these objects the Council gave the use of the rooms and library free, only stipulating that the cost of lighting and necessary attendance should be paid, and that students availing themselves of these privileges should register their names in conformity with the by-laws.

For some unexplained reason the meetings have not been continued, and the privileges granted have not been taken advantage of.

STANDARD FORM OF CONTRACT.—Owing to the difficulty before referred to of holding meetings, because of the non-attendance of members of Council, the preparation of a standard form of contract could not be undertaken, and this matter will have to be referred to the new Council.

AMENDMENTS OF CHARTER.—The members of the Association resident in Quebec presented a number of amendments which they wished to have made in the charter, but after careful consideration the Council deemed it best not to approach the Legislature for the present.

AUGE BILL.—When this bill was before the last session of the Legislative Assembly, the Council, as on former occasions, asked for its repeal. Although their request was not granted, such modifications were made as to do away with the most objectionable clauses.

ART COMMITTEE.—A committee appointed by the Council to confer with the corporation of Montreal and request the appointment of a Standing Art Committee had interviews with the mayor. The mayor expressed himself in favor of the appointment of such a committee, and promised to bring the matter before the Council and aldermen, but so far no definite action has been taken, and the matter still remains in obeyance.

BUILDING BY-LAWS.—The committee regret that the corporation of Montreal have not yet given consideration nor effect to the building by-laws prepared by the committee appointed by it, and on which so much time and labor was expended. It is hoped that the corporation may at an early date adopt the by-laws as submitted to them.

EXAMINATIONS FOR REGISTRATION.—At the semi-annual examinations held in Quebec in the month of January, three candidates presented themselves for examination for registration—all of whom, namely: Messrs. J. E. Payette, J. Forget Despatie and P. A. R. Labelle—succeeded in passing in the subjects prescribed in the by-laws, and received their diplomas. At the same examinations one candidate, M. P. Leveque, presented himself for matriculation examination, and was successful in passing.

At the semi-annual examinations in July only one candidate entered for matriculation, M. Rene Frechette. As he was from Quebec, the examiners did not think it worth while for him to undertake the journey when there were no other candidates. It was therefore proposed that the candidate present himself for examination next January, and that if he succeeded in passing his time of study would date from July last.

The Council have to report the following case which has been presented to them and in which they could not grant the request made without violating the act of incorporation and by-laws. The case is as follows: A student passed the matriculation examinations and then entered the office of an architect who is not registered. Having completed his term of probation, he wishes to enter for final examination and, if successful, be registered.

As this case presents difficulties that the Council did not feel warranted in overcoming without violating our charter, it is referred to this meeting.

LIBRARY.—No additions have been made to the library during the year, except "Les Grands Prix d'Architecture," engraved and published by A. L. F. Vandoyer and L. P. Baltard, Paris, 1834, donated by M. J. Venne, and the proceedings of the Ameri-

can Institute of Architects. The periodicals subscribed for by the Association have been bound and placed on the shelves.

MONTHLY DINNERS AND PAPERS.—During the winter months the dinners and reading of papers instituted in former years were maintained, but, owing to the apathy of members, they were not so successful as they should be.

The following papers were prepared for these monthly meetings: "Ancient Rome," with lime light illustrations, by Alex. C. Hutchison; "Old Colonial Architecture," by Robert Findlay; "Truth in Architecture," by W. E. Doran; "Evolution of the Plan in Building," by Jos. Venne.

MONT ST. LOUIS INSTITUTE.—The directors of the Mont St. Louis Institute have made the request that in view of the course of instruction in architecture given to their pupils, that the time required for service in an architect's office after they have been admitted to study shall be three instead of four years. As the granting of this request would be in conflict with the act of incorporation and by-laws, the question is referred to this meeting.

REGISTER.—The names of several members have been removed from the register for non-compliance with the by-laws respecting the payment of subscription, and the Council regret to record the decease of M. J. B. Resther, who took an active interest in the formation of the Association, and was ever ready to assist in furthering its objects. A special meeting was called on the day of his funeral and a suitable minute of condolence made, and a copy sent to the family. A wreath of flowers was also sent and placed upon the coffin.

ATTENDANCE AT MEETINGS.—The following is a record of the attendance of members at meetings of council: A. C. Hutchison, president, 20; A. T. Taylor, 17; J. Venne, 20; J. Perrault, 14; R. Findlay, 14; J. B. Resther, 6; A. H. Lapierre, 7; T. Daoust, 4. Messrs. J. F. Peachy, 2nd vice president, C. Baillarge and G. E. Tanguay, residing in Quebec, are not inscribed in this register.

There were, besides the requested meetings of Council, a number of meetings of committees appointed by the Council to assist in carrying out the work of the Association, more particularly in connection with the exhibits.

The Council would place on record its appreciation of the assistance thus rendered.

THE PRESS.—The thanks of the Association are tendered to the Press for interest and notice of its proceedings.

JOS. VENNE, Secretary.

The report submitted by the Treasurer, Mr. Jos. Perrault, was of a very satisfactory character, showing a strong balance to the credit of the Association in bank.

The reports of the Council and the Treasurer having been adopted, the election of officers was proceeded with, and resulted as follows, the scrutineers being Messrs. G. E. Tanguay, of Quebec, and H. C. Nelson, of Montreal: President, A. T. Taylor, Montreal; first Vice-President, J. F. Peachy, Quebec; second Vice-President, A. Raza, Montreal; Secretary, Jos. Venne, Montreal; Treasurer, E. Maxwell, Montreal; Council, A. C. Hutchison, Jas. Nelson, J. Wright, R. Findlay, Montreal, Chas. Baillarge and F. X. Berlinguet of Quebec.

Auditors: Messrs. G. E. Tanguay and H. C. Nelson.

The most important feature took place in the forenoon session on the tariff of charges. There were lively discussions. M. Berlinguet, of Quebec, said that the tariff at present in the hands of the Lieut. Governor should not be sanctioned, being in some respects too high and in others too low. M. Baillarge called the attention of the meeting to the fact that an architect was not allowed to testify in his own case, as the other professional men could do.

It was proposed by Mr. A. Raza, seconded by Mr. Perrault, that this important question should be referred to the new Council for consideration at a special meeting, and that a report thereon be presented as soon as possible.

The idea of having a Dominion Association of Architects was favorably received, and has been referred to the same committee. Mr. C. Baillarge, of Quebec, and M. Perrault referred to the advantages of such an association.

The request of the authorities of the Mount St. Louis Institute was taken into consideration, but no immediate conclusion was reached.

The retiring president then introduced his successor, Mr. A. T. Taylor, who thanked the members of the Association for the honor conferred upon him, and said that he hoped that they would help him to make the Association a flourishing one.

In the afternoon the invited guests and Quebec members were driven through the city and to Laval University and the Diosesan College of Theology, which buildings they thoroughly inspected. The party then went around the mountain and greatly enjoyed the scenery.

THE EXHIBITION.

The second exhibition held under the auspices of the Province of Quebec Association of Architects in the galleries of the Art Association, Phillips Square, was a pronounced success in every respect, and augurs well for similar undertakings in the future.

Although the drawings were inferior in number to those of the exhibition of two years ago, there was a noticeable advance in point of excellence which ought to amply reward the promoters for their labor, and be appreciated by the profession as a whole, and the public at large.

If the architectural drawings occupied less space than in the former exhibition, together with the exhibits of the Arts and Crafts Department, the entire space occupied this year was far greater, two galleries being entirely taken up, and part of a third. The Arts and Crafts Department was a most valuable addition and is destined to bring to light many an ignored artist in the line of decorative sculpture, painting, iron work, and other allied arts closely connected to architecture.

The exhibition was inaugurated in the evening by a delightful conversazione, which was attended by a large and select society. Sweet music was discoursed and refreshments served in the large class room adjoining the new gallery.

The following is a list of the drawings exhibited—in alphabetical order by authors:

Archibald, John S., Montreal, 1, Church of St. Bertrand and Street in Lisle, France; Barnes, R. Percy, Montreal, 2, Church at Philipsburgh, 3, "Claremont," Pointe Claire, 4, "Glynn Hedd," Lachine; Bigelow, Henry Forbes, Boston, U. S., 5, Perspective of St. Mark's School, Southborough, Mass., 6, Perspective of the Grand Stand for Readville Trotting Park, U. S. A., 7, Perspective of a Block of Shops at Gilbertsville, New York, U. S. A.; Brown, McVicar & Heriot, Montreal, 8, Summer Hotel at Chambly, 9, Sketch for Three Houses, 10, Interior of Hall, 11, Apartment House, Peel street, 12, Sketch for an Apartment House, 13, Residence of C. Davidson, 14, Residence of A. J. Inglis, Westmount; Cox & Amos, Montreal, 15, a Block of Seven Cottages at Westmount, 16, Designs for Additions to the College of St. Laurent, 17, Design for Altar and Reredos Church at Rougemont, P. Q., 18, Block of Stores, St. Catharine Street, 19, House at Westmount, 20, Residence at Kensington; Daoust, Theodore, Montreal, 124, Perspective of College at St. Henry, 125, Front Elevation of House; Department of Public Works, Ottawa, 21, Interior of Library of Parliament, 22, Perspective of Drill Hall, Halifax, 23 to 31, Public Buildings at Winnipeg, Victoria, Berlin, Port Hope, Clifton, Hull, Bathurst, New-

castle and Amherst respectively; Dufort, Cajetan, Montreal, 32, Detail of a Courtyard, 33, Chickering Hall, 34, House of Geo. Willis, Chicago, 35, Columbia College, 36, Swampscott, 37, a Summer Residence; Findlay, Robert, Montreal, 38, Residence of W. M. Knowles, 39, Residence of Dr. D. F. Gurd, 40, Residence of R. Findlay, 41, Residence of J. L. Morris, 42, Residence of W. R. Miller, 43, Residence of J. Allan, 44, Residence of J. S. Sheffield; Finley, S. Arnold, Montreal, 45, Sketch of Old House at Laval, France, 46, Sketch of Old English House, 47, Sketch for Shooting Box, 48, Rambling Sketches; Fuller, Thomas, Ottawa, 40, Design for Capitol at Albany, 50, Design for Church, 51, Ground Plan of Public Building at Victoria; Gardiner, J. Rawson, Montreal, 52, Design for Board of Trade Building, 53, Two Cottages, Green ave., 54, Lindfield Church, England, 55, a Lakeside Cottage, 56, a Bit in Westminster Abbey; Hutchison, Alex C., Montreal, 57, Two Villas at Westmount, 58, Y.W.C.A. Association Building, 59, Proposed Melville Church, Westmount, 60, Design for Hospital, 61, Design for Presbyterian Church, Point St. Charles; Kilham, Walter H., Boston, U.S., 62, Group of French Towers, 63, Italian Doorways, 64, Study for Custom House; Lindsay, H., Montreal, 65, Perspective of Hall in Residence of Mrs. J. Levy—Messrs. J. & H. C. Nelson, architects; MacVicar, D. Norman, Montreal, 66, Sketches in Reims, France, 67, "Town Tower," Oxford; Maginnis, Charles D., Boston, U. S., 68, Massachusetts State House, Boston, 69, Sketches in Rouen, France; Mann, Eric, Montreal, 70, a Street in Old Edinburgh, 71, Residence for M. S. Foley; Maxwell, Edward, Montreal, 72, Board of Trade Building, Montreal—Shepley, Rutan & Coolidge, architects—73, Westmount Primary School, 74, Bell Telephone Building, Montreal, 75, Bell Telephone Building at Winnipeg, 76, R. J. Tooke's Building, 77, Banking Room in Bell Telephone Building, Montreal, 78, Residences, Montreal, 79, Cottages, 80, a Study, 81, Chapel at Avignon, France, 82, St. Ouen, Rouen, France, 83, Foreign Sketches, 84, Tower of University—Chapel Palo Alto, California, 85, Country Residence, 86, Bridge, Back Bay, Fens, Boston, 87, Study for a Residence; Miller, J. Melville, Montreal, 88, a Mountain Hotel; Mitchell, C. Alexander, Montreal, 89, Sketch of Old House, Grey street, 90, Sketch of Old Porch in Normandy, France; Nelson, J. & H. C., Montreal, 91, Perspective of House for Mrs. J. Levy; Nelson, H. C., Montreal, 126, The Old Savage Farmhouse, Sherbrooke Street, 127, The La Salle House, Lower Lachine Road; Patterson, C. B., Montreal, 92, Residence Baltimore, 93, Sketch for Church; Payette, Eugene, Montreal, 94, A City Residence, Submitted in Final Examination to the P. Q. A. A.; Perrin, W. M., Montreal, 95, Perspective of Frame House, 96, Perspective of Stone House, 97, Perspective of Chapel, 98, Rendering from Photograph, 99, Cottage in Sepia; Raza, Alphonse, Montreal, 100, Residence of O. Faucher, 101, Club House, Lake Chapleau, 102, Residence for A. Armot; Rodden, R. M., Montreal, 103, 104, 105, Plans For Public Library; Saxe, C. J., Montreal, 106 and 107, City Mansion, 108, Colonial Residence, 109, County Residence, 110, Summer Residence, 111, Shakespeare's House, Stratford-on-Avon, 112, Sketch; Taylor, Andrew T., F.R.I.B.A., Montreal, 113, Diocesan Theological College, Montreal, 114, Bank of Montreal, Seigneurs Street Branch, 115, Additions to Art Gallery, Montreal, 116, Leaves From a Sketch Book; Venne, Joseph, Montreal, 117 and 118, Perspective Views of a Church, 119, Competition Design for Church at St. Jerome; Winslow and Wetherell, Boston, U. S., 120, House at Lake Massahesic, N. H., 120 and 123, Houses at Brookline, 122, Business Premises for Shreve, Crump & Son, Boston.

Mr. Andrew T. Taylor, F. R. I. B. A., contributed water color perspectives of buildings of actual interest, such as the Diocesan Theological College just completed, which undoubtedly ranks amongst the best of the very interesting buildings erected by this talented architect. The drawing representing this building although well rendered in color, conveys but a faint idea of the beauty of the original. In plan three sides of a quadrangle overlook University street, the principal side carrying a graceful tower in its axis while opposite an elaborate gothic gateway separates the court from the street. It is thoroughly English in character and we feel that Mr. Taylor was well at home in designing this building and succeeded without effort in making it what he intended it to be. A water color perspective of the new Art Gallery shows also with advantage, together with five or six water colors of Italian towers which could well form part of a worthy pendant to "Sir Christopher Wren's Towers and Spires," which Mr. Taylor had published in London by Botsford when practising in the Commercial Metropolis.

Mr. Joseph Venne exhibits two perspective drawings of a proposed church, one of the interior rendered in color, and one of the exterior rendered in ink. The porch is remarkably well proportioned and detailed, as is also the choir, which is well studied. The interior is of a semi-classical character and very rich and elaborate in design. An elevation of a competitive design for a church at St. Jerome also exhibited by Mr. Venne has well proportioned and arranged doorways.

Mr. A. C. Hutchison had two perspectives of villa residences erected at Westmount, designed in the American style and very well rendered in ink, together with other remarkable drawings, amongst which is the Y. W. C. Ass'n. building designed in very good taste.

Messrs. J. & H. C. Nelson's house for Mrs. J. Levy shown by two drawings rendered in ink is an agreeable and unpretentious design with a well arranged and detailed staircase.

Messrs. Findlay and Maxwell exhibited a large number of drawings—the former having mostly pen and ink drawings, while the latter exhibited mostly water colors, which were much admired.

Nearly all of the drawings sent in by American architects are also worthy of praise, and the Arts and Crafts Department had also very interesting and numerous exhibits which would also deserve some attention but the space being so very limited in this number, little can be said for the present.

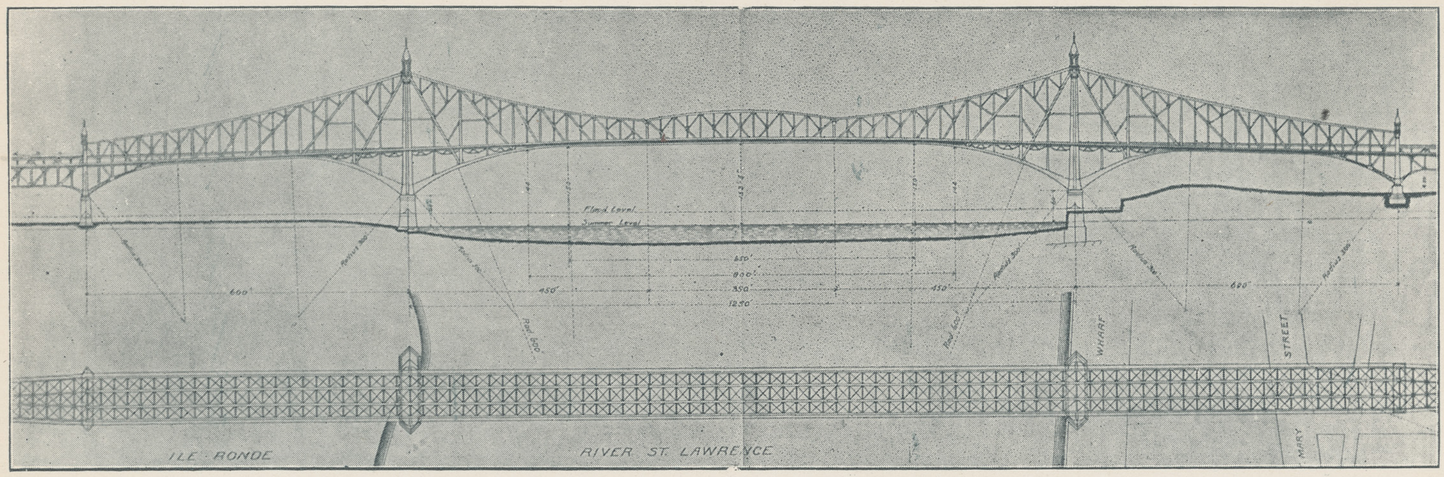
We cannot, however, close without mentioning Mr. Philippe Hebert's beautiful group entitled "Le Rapt" representing an Indian holding a girl on his shoulder with his left hand and a threatening knife in his right hand.

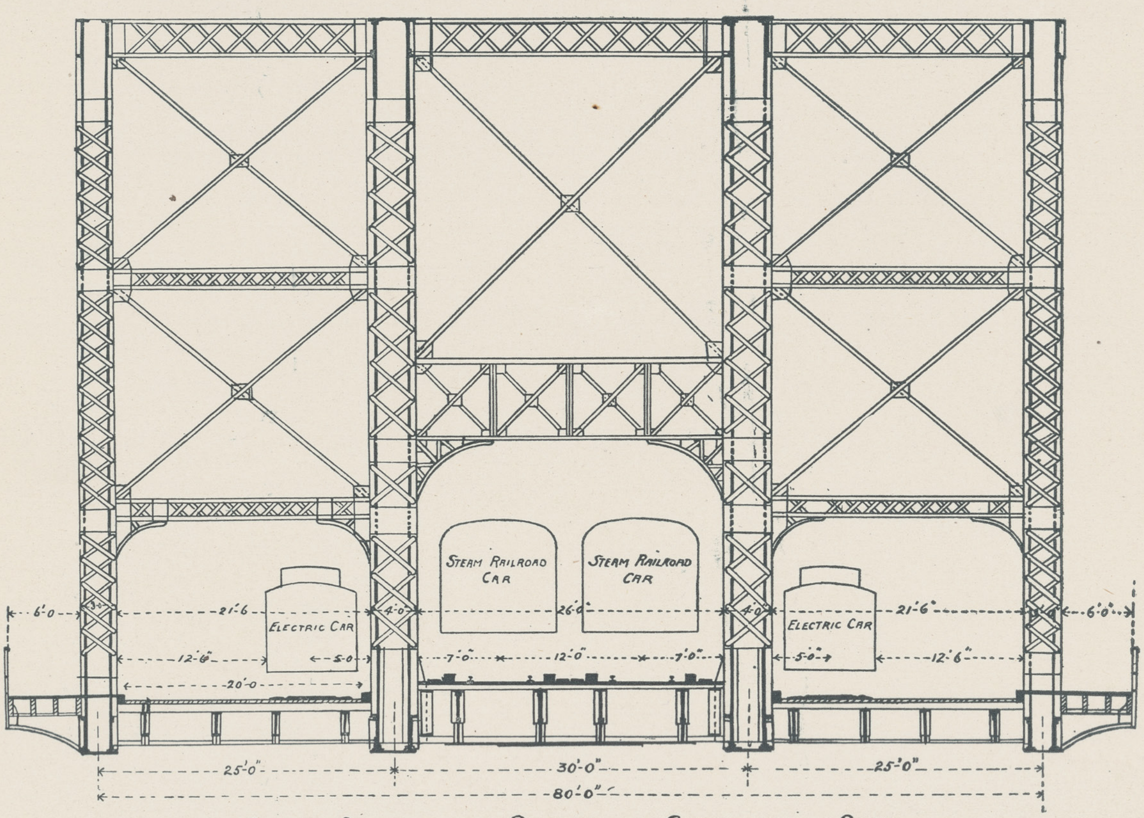
Mr. Page exhibits some iron chandeliers and grilles refined in design and of a finish rarely met with in daily practice.

Briefly the success and high degree of excellence which the present exhibition has attained is a guarantee that regular and periodical exhibitions of this character will be held in the future, which institution would do a good deal for the advancement of architecture, and a more intelligent appreciation of that useful art by the masses.

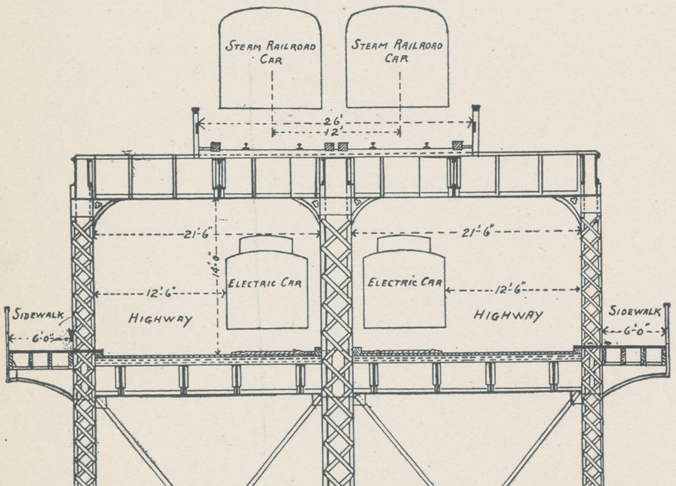
Residence of Mr. Columbus Green, St. George Street, Toronto.

Beaumont Jarvis, Architect.

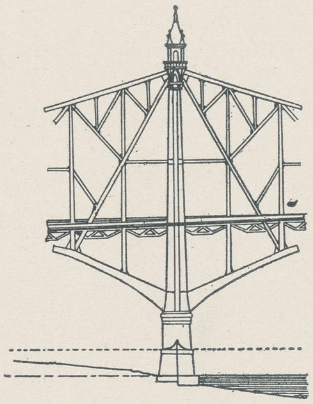


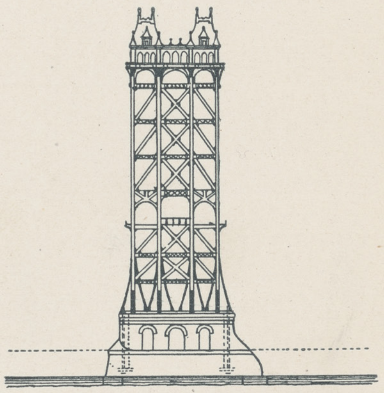


CROSS SECTION AT CENTRE OF CANTILEVER SPAN

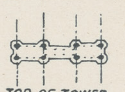


CROSS SECTION OF SOUTH APPROACH.

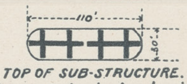




MAIN PIER ~ ILE RONDE
CROSS SECTIONAL ELEVATION



TOP OF TOWER

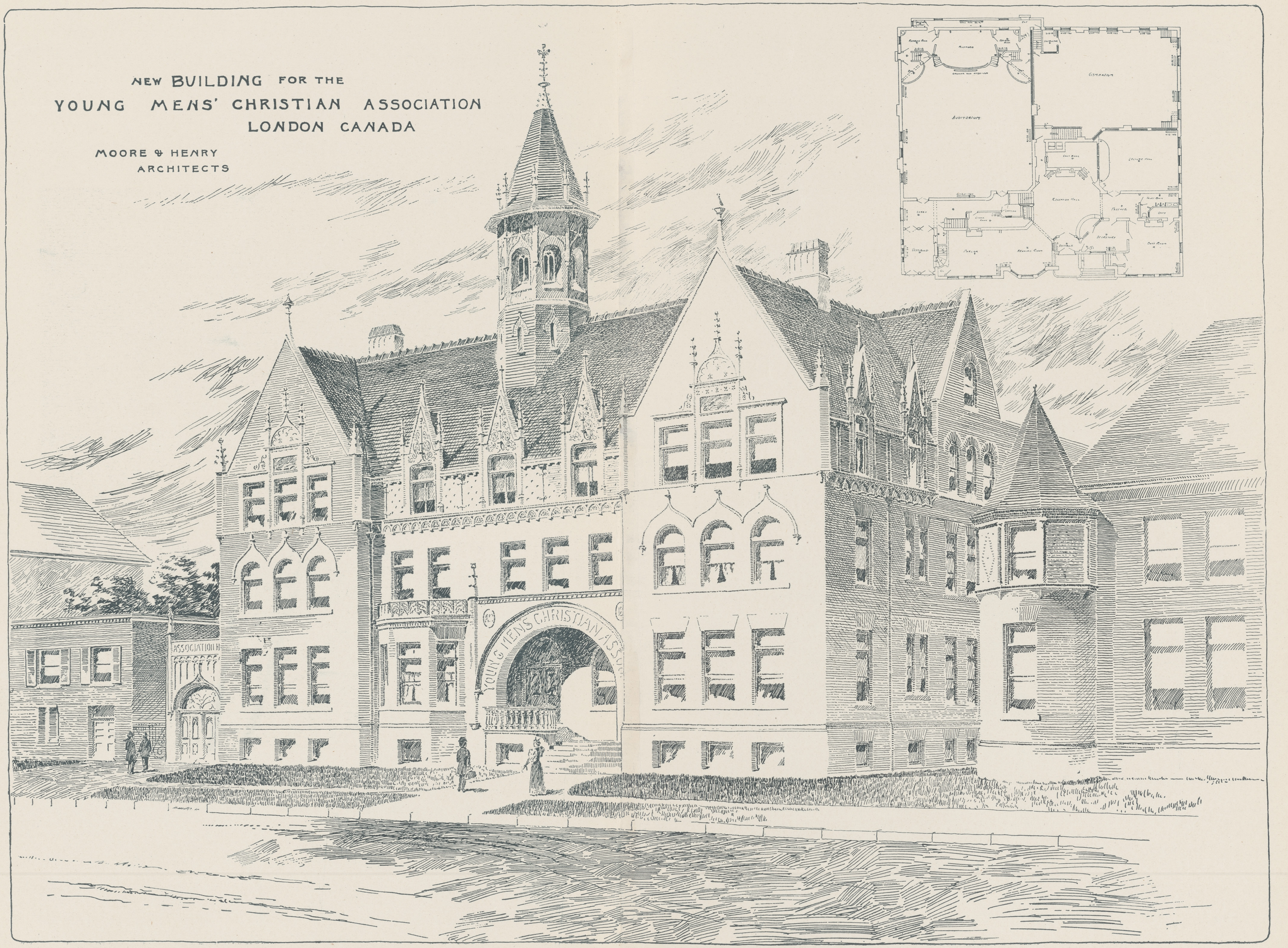


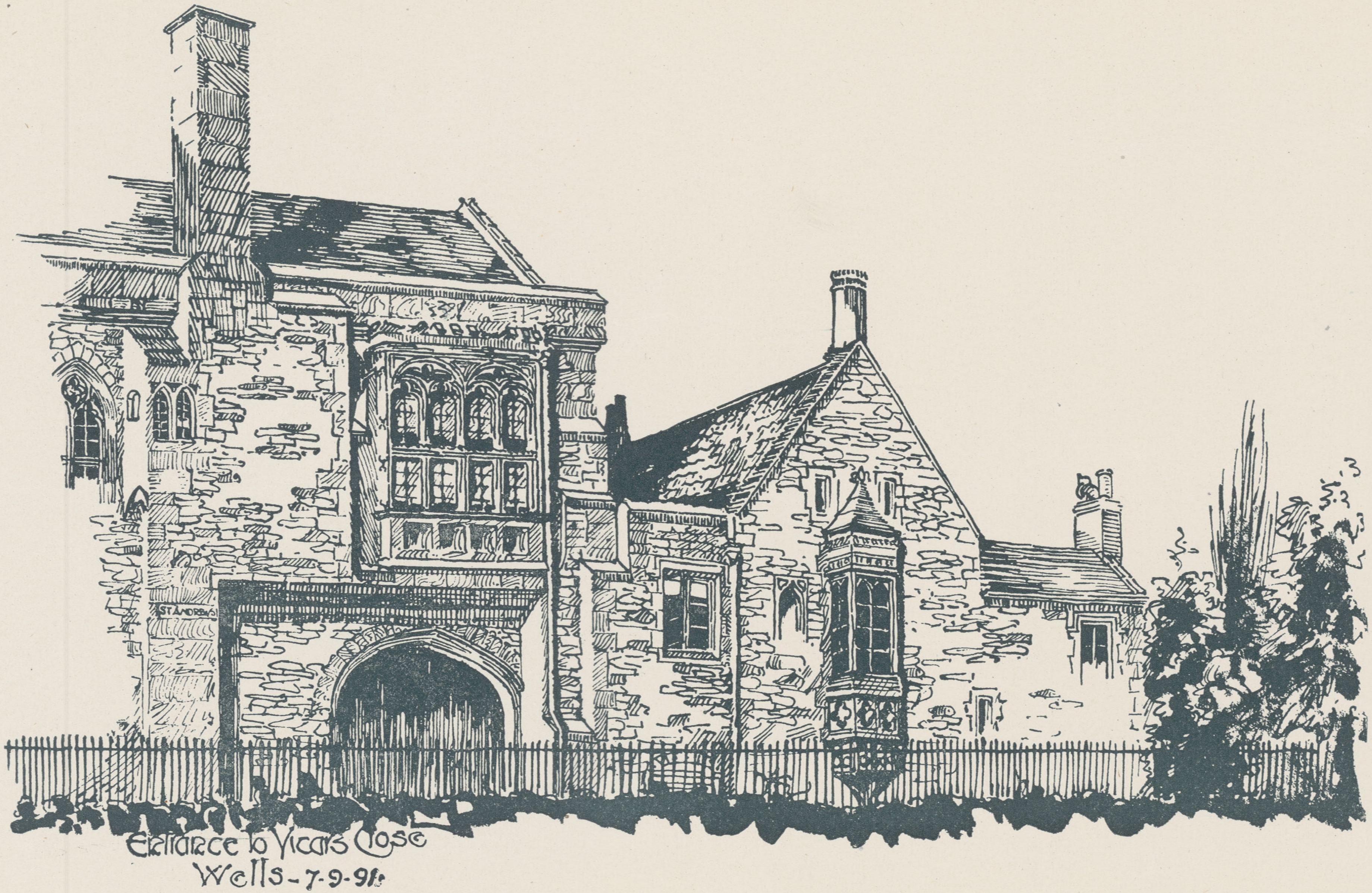
TOP OF SUB-STRUCTURE.
Showing superstructure bearings

SECTIONAL PLAN
Section through arches
above highest flood line

FIRST PREMIATED DESIGN FOR PROPOSED CANTILEVER BRIDGE OVER THE ST. LAWRENCE RIVER AT MONTREAL.

SUBMITTED BY EDWARD S. SHAW, C. E., BOSTON, MASS.


NEW BUILDING FOR THE
YOUNG MENS' CHRISTIAN ASSOCIATION
LONDON CANADA
MOORE & HENRY
ARCHITECTS



Entrance to Vicar's Close, Wells Cathedral.

Sketched by Mr. Frank S. Baker, A. R. I. B. A.

ILLUSTRATIONS.

ENTRANCE TO VICAR'S CLOSE, WELLS CATHEDRAL.—SKETCHED BY MR. FRANK S. BAKER, A. R. I. B. A.

RESIDENCE OF MR. COLUMBUS GREENE, ST. GEORGE STREET, TORONTO.—BEAUMONT JARVIS, ARCHITECT.

The materials employed in the construction of this house are plum-colored hard burned brick and light grey stone. The trimmings are painted in bronze green.

YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, LONDON, ONT —MOORE & HENRY, ARCHITECTS.

The building is 110 feet by 100 feet, 4 stories high, built of stone and brick, with slate roof and plate glass windows.

The basement contains the bowling alleys, swimming tank, locker and dressing rooms, shower, tub and needle baths, toilet rooms, heating apparatus, etc. The first floor contains an octagonal reception hall, secretary's offices, boys' rooms, reading room, large parlor, lecture hall and gymnasium, together with cloak rooms and toilet rooms. The auditorium is also on the first floor with a separate entrance having direct access to the street. The second floor contains the board room, ladies' parlor, large entertainment hall, kitchen, upper part of gymnasium, with running track and visitors' gallery and the gallery of the auditorium, also the quarters of the London Etomological Society. The third floor contains class rooms, public and private offices, cloak rooms, etc.

The whole building is thoroughly lighted and ventilated, having wide corridors running through to connect the different apartments, wide staircases, and is to be heated by low-pressure steam with thorough ventilation. The contracts call for the building to be completed in October, 1896.

DESCRIPTION OF THE FIRST PRIZE DESIGN FOR THE CANTILEVER BRIDGE, OVER THE RIVER ST. LAWRENCE.—BY EDWARD S. SHAW, C. E., BOSTON, MASS., U. S. A.

It is proposed to build this bridge over the River St. Lawrence, about two miles below the Victoria bridge, with a long cantilever span of 1250 feet, over the main ship channel, and at a clear height, throughout the central portion of this span, of 150 feet above the summer level of the river. The approach viaduct on the Montreal side will commence near the corner of Delorimier avenue and St. Catherine street, thence upon a curve and over the shore span of the cantilever bridge to the main pier of the long span, situated on the edge of the wharf near Belle Rive Park. Thence the long span crosses the main channel to the other main pier and beyond to an anchorage pier, both upon Ile Ronde, a small island in the river just below St. Helen's Island. From Ile Ronde the wider but shallower portion of the river is crossed by a bridge and viaduct on a descending grade to the Longueuil shore.

In the advertisement for competitive designs issued by the Montreal Bridge Company, certain requirements were given, the most important of which were the length of and clear height above water of the channel span, and the nature of the traffic over the bridge to be provided for, this latter being stated to require two railway tracks, two tracks for electric street cars, a highway for ordinary vehicles and two footways. Other minor stipulations were made, and a blue print outline of a design was sent out to applicants, but it was stated that these were not intended to hamper designers, original designs being invited.

The accompanying illustrations show, as one of the main features of this design, two massive stone piers, situated upon the margins of the main ship channel on the Montreal wharf and on Ile Ronde, each 110 feet by 30 feet in plan, at the top, and rising to a height of 60 feet above the summer level of the river, these piers being surmounted by the balanced arches, of compound curvature, of the superstructure. In continuation of the ascending lines of the stone pier, a steel pier or column of massive proportions towers to the height of 230 feet above the sub-pier, or fully 300 feet from summer water to the lanterns or turrets upon the summit.

From the tops of these towers the upper cords descend in approximate catenary curves, suggesting the curves of the main cables of a suspension bridge, to the junction with the free span of 350 feet which connects the two cantilever arms, these arms being each 450 feet in length.

The long span of 1250 feet and its two flanking spans of 600 feet each are divided by the four main trusses into three longitudinal ways, the middle of which, 26 feet in clear width, carries the double track steam railway, while the two side passages, each 21½ feet in clear width, suffice for the highway and street car tracks. Bracketed out from the outer trusses are the sidewalks, 6 feet in clear width each.

Throughout the middle portion of the long span, for a distance of 650 feet, the elevations of the several ways are practically the same, this portion of the bridge being built with a camber or slight upward curve, increasing the headroom at the centre to 153 feet. Commencing at points on this span, distant 300 feet from each of the main piers, the approach grades (2 per cent. and 4 per cent. respectively), of the railway and highway commence, the greater grade of the highway, street car tracks and sidewalks sufficing to bring down these portions of the floor enough to pass under the railway tracks upon the spans adjacent to the anchor piers, and to continue under, and descend with the same grade as the railway tracks, upon the approaches.

The main trusses or longitudinal supporting frames of the cantilever and flanking spans, as well as the trusses of the approaches are built vertical or plumb, instead of in planes inclined outwardly or "battering," as in the Forth bridge and also in many high viaducts and long span arch bridges. Where a bridge supports only a single or double track railway or narrow or medium width highway it is necessary to spread the base of the supporting trusses, arches or towers, to secure sufficient stability to prevent the structure from being overturned by excessive wind pressure, but in this structure on account of the great breadth of the bridge required for the several ways, this breadth being 80 feet measured between centres of outer trusses, it is apparent that it may not be necessary to slope or batter the trusses in order to obtain the requisite base to render the structure stable against the most severe winds of ordinary or periodical and frequent occurrence, and in this design the trusses have been placed in vertical planes, with advantages of simplicity of design and cost of construction. In the main piers steel buttresses are built out at right angles to the plane of the trusses, increasing the width of the superstructure base, and heavy steel anchors are provided, extending down almost to the base of the masonry sub-piers near their

ends, to guard against the possible effect of winds of extraordinary violence.

The lower chords of the flanking spans of the cantilever bridge, and of the longer spans of the south approach, are curved down to the stone piers of the substructure, both to diminish the height of, and quantity of masonry in the substructure and to improve the appearance of these portions of the design.

In the south approach there are 15 spans ranging from 300 feet down to 160 feet, the lengths and depths of these spans being varied in approximate proportion to the height of grade above the water. From the last span shown on the southerly side, the highway and electric car tracks are carried upon a solid embankment, with sloping rock-built sides, the railway being upon an elevated structure over the middle of the highway.

The approach viaduct, upon the curve on the Montreal side, is a structure simulating an arch viaduct, with full centre round arched trusses, having a sufficient centre depth to be self-supporting and to exert no horizontal thrust upon the substructure, under vertical loads.

It is proposed to use the European style of all riveted connections throughout, no eye-bars or pin connections being used, excepting possibly in anchorages. While the pin connected method of bridge construction is preferred by the majority of bridge engineers in the United States, short span bridges excepted, the riveted method is almost exclusively used in Europe, and the immense Forth bridge, the largest rigid bridge in the world, stands as a conspicuous precedent for the employment of this system of construction for bridges of exceptional magnitude.

The bridge has been designed to carry a heavy train of locomotives and cars upon both of the railway tracks with a proper allowance for the travel upon the highways and sidewalks, and for wind pressures, and with working strains ranging from 1/6 to 1/3 of the breaking strength of the material, according to position and duty.

It is proposed to use mild open hearth steel throughout, having an ultimate tensile strength from 60,000 to 72,000 pounds per square inch, and with restrictions as to the amount of phosphorus and sulphur, the impurities which, if contained in excess, are most prejudicial to the good quality of steel, and its ability to resist impact, or sudden blows or shocks.

The estimated weight of structural steel is 37,000 tons of 2,000 pounds, and the estimated cost of the superstructure is $3,514,000.

MONTREAL BRIDGE—LIVE LOADS AND WIND PRESSURES.

Length of bridge covered by load—feet.	Live load on single track—lbs. per lin. ft.	Live load on highway—lbs. per square ft.	Live load on sidewalk—lbs. per square ft.	Total live load—lbs. per lineal ft.	Wind pressure, bridge empty—lbs. per sq. ft.	Wind pressure, tracks loaded—lbs. per sq. ft.
20	8,000	210	110	25,720	90	50
30	6,330	160	93.3	20,190	73.3	41.7
40	5,500	135	85	17,420	65	37.5
50	5,000	120	80	15,760	60	35
60	4,670	110	73.3	14,610	56.7	33.3
80	4,250	97.5	7[illegible].5	13,270	52.5	31.3
100	4,000	90	70	12,440	50	30
120	3,830	85	68.4	11,890	48.3	29.2
160	3,630	78.8	66.3	11,200	46.3	28.1
200	3,500	75	65	10,780	45	27.5
240	3,420	72.5	64.2	10,510	44.2	27.1
250	3,400	72	64	10 450	44	27
270	3,370	71.2	63.8	10,350	43.7	26.9
300	3,330	70	63.3	10,220	43.3	26.7
350	3,290	68.9	62.7	10,070	42.9	26.4
800	3,130	63.8	61.3	9,540	41.3	25.6
1250	3,080	62.4	60.8	9,390	40.8	25.4
1400	3,070	62.1	60.7	9,350	40.7	25.4

EDWD. S. SHAW, C. E., Boston, Mass.

A WORD OF CAUTION.

THE enthusiastic Canadian student of architecture who may be planning a visit to the Paris Exhibition of 1900, will do well to remember that in some of the Provincial towns a person attempting to make a sketch in the streets is liable to find himself arrested and held by the police as the emissary of a foreign nation which is preparing for the invasion and conquest of the republic. The absurdity of such official interference appears to have dawned upon the mind of the Prefect of Police of Paris, for an order was recently issued that artists and photographers are not to be interfered with unless by reason of them crowds of people congregate and impede the traffic in the streets.

PRISMATIC GLASS.

ONE of the latest and probably most important improvements in building material is the prismatic glass for transoms and sidewalks, introduced by the Prismatic Glass Company a few months ago. This window glass is made in small squares, which are put together with lead or other material to suit size of windows or transoms. The inner surface of the glass is covered by horizontal ridges or half prisms. These half prisms are so constructed that when a light ray which falls naturally at an angle of about 45 degrees passes through this glass it becomes refracted or bent upwards and is carried out horizontally into the interior of a room instead of falling to the ground or floor at the natural angle. This is a very simple contrivance, but the result is wonderful. In one jewelry store in Toronto, where the glass has been introduced, before using the prismatic glass, upwards of 40 and on cloudy days 80 incandescent lights were required to give sufficient light in the interior. Since using prismatic glass the proprietors of the store say that they have not required any artificial light except on very dark days, and that they have saved from $40 to $80 per month in their artificial light bills. The same result has been experienced by three of the largest departmental stores in Toronto who are using the glass. Architects and owners who have used prismatic glass are emphatic in their praise of its result.

The sidewalk lights work on a somewhat different principle. The rear surface of each prism acts as an independent reflector and an ingenious but simple arrangement is made so as to provide for the slant of a sidewalk, and still allow these reflectors to throw light into the interior of a basement without being diverted or tilted up, which is the result in most pendant or prismatic sidewalk lights.

Although only on the market for a few months in Canada, both prismatic window glass and the sidewalk lights have met with large sales and nearly all the important merchantile and commercial buildings erected in the principal cities in Canada have been fitted out with this glass.

The use of this glass does away with the necessity of light wells and sky lights, which always serve as fire traps and use up valuable space.

The City of Venice has announced its intention of holding a second International Art Exhibition, to contain pictures, sculptures, etchings, and drawings, from April 22 to October 31, 1897. Prizes for the best works to the amount of not less than 40,000 lire will be awarded by an international jury of artists. The Municipality of Venice will grant three prizes of 1,500, 1,000 and 500 lire respectively for the best critical essays on the exhibition, published during the first month after the opening. Artists must give notice of their intention to exhibit not later than January 1.—The Building News.

As it is often difficult to obtain any information concerning the inside height of a church or other building, Korber mentions in the "Deutsche Techniker Zeitung" that he has found toy ballons very useful for this purpose. The string must, of course, be very light. A straw smeared with a little glue placed at the top of the balloon helps to keep it in position for a few moments. It may, unfortunately, prove quite as difficult to procure a toy balloon good enough for the purpose, as to hunt up papers and drawings containing the desired information· But Korber is not wrong, when he says that somebody might prepare balloons specially for this purpose.

STUDENTS' DEPARTMENT.

THE PRACTICAL SIDE OF TRAVELLING.

UNDER this heading Mr. A. Needham Wilson gives the following hints in A. A. Notes to architectural students abroad in search of knowledge :

It seems to be a somewhat invidious task to lay down any general rules of procedure for foreign sketching tours, the necessities and circumstances differ so widely according to the line of route of the country traversed that nothing more than personal experiences can be given, and the neophyte must glean what he can from the variety offered him. It has to be borne in mind that the student is about to study architecture produced under a different aspect, under a different climate, and governed by atmospheric conditions totally distinct from those of our own country, and though it may be necessary to lay down some fixed route, or fix upon a list of notable buildings, there must be a temptation to search for untrodden ground. Some notion—further than a mere broadening of ideas—of future usefulness, must be in the mind of the student, to be gathered from the material he will collect during his tour, and naturally he will pick this up as fancy leads him. Therefore I venture to think the idea of working from some centre is a useful one. More luggage can then be carried, as the bulk can then be left at your base, and bare necessities only taken afield. Sometimes it will be found practicable to live in apartments, or en pension, and then a few luxuries will be found most welcome. To Mr. Bolton's suggestions as to outfit, I have little to add, as I consider them excellent. There are one or two points, however, to which attention might be given, Slow drying water colors will be found very necessary in extremely hot weather, and personally I found two folding campstools indispensable. They are light and easy to carry, and for plotting dimensions on the spot, form a handy trestle for the drawing-board by placing one above the other. For certain work a bamboo rod or reed, 10 or 15 feet long, will be found very useful in measuring to otherwise inacessible points. These are generally easily procured, and need not be carried from place to place, and, above all, take a sketching umbrella.

Personally speaking, I cannot say I have found such extreme difficulty with regard to credit notes as Mr. Bolton has, as the centres from which I worked had duly accredited agents, and I certainly never lost by the exchange. It must be understood that I write of certain parts of the south of France, with which I am more intimately acquainted. Living there is extremely cheap, providing that you shun the grand hotels.

My companion and I lived luxuriously at one small hotel for forty francs a week for the two, "en pension."

Mr. Bolton appears to stand in great awe of concierge and sacristan, and speaks contemptuously of introductions. I certainly agree with him that the credentials furnished by the Royal Institute are of little use, but the best credentials I had were cards furnished by a government architect to whom I had an introduction. It proved an "open sesame" to me to everything. A case in point. I had seen through an archway a court, in a certain city. I applied for permission to sketch. The owner, a noble, was absent. The concierge said it would be all right. We accordingly commenced work. A scion of the noble house turned us ignominiously into the street. We produced our credentials — our passport, our Institute card, our Academy bone, our A. A. ticket, our letter. We implored ; we threatened to write to the Times ; but the stony-hearted youth (about fifteen) saw us off the premises. We went to our protector and returned armed with a note. Instantly the place was at our feet. "Everything is at Monsieur's service." "Would Monsieur like a table and a chair?" M. le Comte regaled us with Malaga ; we had the run of the place ; we sketched old furniture. Madame la Comtesse apologized, and we felt that we were Britons again. Armed with those cards we penetrated places that no Briton had ever seen or heard of. We walked unscathed amid police and "gendarmerie," and even sketched the ancient tower of the "Mairie" at Avignon from a window of the gendarmerie itself. I never bothered with sacristans and concierges. I went invariably to the head authority and procured proper permission. In this I never failed, and as a result was never interfered with. Of course, in travelling from the beaten track, I repeatedly had to seek permission to sketch where no sacristans or guardians existed, and then I found our powerful friend's influence most marked. The permission of the priest or other in charge never failed to secure me from any annoyance. I certainly found it saved instead of wasted time.

Do not let a student go abroad with a fixed idea that the fact of his being an Englishman is sufficient to secure him the entree everywhere, without proper permission. Such conduct causes more trouble and gives us a worse character than many imagine ; and certainly if you differ in creed with that of the church in which you are working, do not offend the susceptibilities of worshippers and authorities by conduct that you would not be guilty of in your own land or church of your own creed. Even if no stipulation to such effect is made, it is expected that you will cease work during Divine Service. Remember that as you act, so it will be better or worse for those who may follow in your footsteps, and an indifference to others' feelings may cause your successors endless trouble. As a case in point, I may mention that the priest in charge of the grand church of S. Trophime, at Arles, hesitated for some time before giving permission on the grounds that other students had persisted in sketching during service and on Sundays. At St. Gillies, Gard, the cure spoke in terms of strong indignation of the conduct of certain English, who, forsooth, because they were Protestants, seemed to think it unnecessary to respect the feelings of those who differed from them. It may be annoying to break off in the middle of your work, but a little arrangement will obviate this. Is it a large church with a fine west elevation?—sketch outside till the sun drives you in. When service commences, go into the cloisters.

Both clergy and sacristans will consider you if you consider them, and, speaking personally, neither in England or abroad have I ever found the consent given grudgingly by the clergy. Though you may have a right to be in a church, it does not follow that you have a right to sketch.

To turn to another matter ; do not be content with a superficial examination of a town. The tide of modern improvements may only have covered up much that is worth the seeking. It is there if you will look for it. Nimes, with few exceptions, is a city of plain streets, and yet a mass of rich Renaissance work was found hidden behind the plain exteriors, much of it sketched

for the first time by an Englishman. In suburbs and outskirts, in outlying towns and villages, I have rarely failed to find something worth a walk. Surely half the charm of a lengthy tour is to discover the unknown.

In conclusion, I would venture to urge the advisability of measuring and plotting to scale on the spot, whenever practicable, whilst everything is at hand and before your eye, and when there is no possibility of the vivid impression fading from your memory.

I would only add to Mr. Bolton's admirable remarks on sketching the advice to draw firmly and strongly.

MANUFACTURES AND MATERIALS

CEMENT WORKS IN GERMANY.

There are, according to Kuhlow, some 63 cement works in the whole of Germany. The Rhine is the principal centre of this manufacture, but in the neighborhood of Hamburg there are three or four in operation for the production of the article. The annual production of Germany amounts to nearly 11,000,000 barrels, giving employment to some 1,800 hands, whose annual earnings amount to some £698,780. The largest customers for this article in Europe are Russia and Norway, and of transatlantic countries, the United States, Brazil, Chili and Venezuela. The exportation to Great Britain and British possessions is comparatively small. The following table gives approximately the quantity and the value exported to European and other countries :

Country.	Cwts.	£
Norway	58,500	6,700
Russia	34,353	2,900
United States	1,380,872	168,000
Brazil	446,340	40,200
Chili	131,000	13,000
Venezuela	103,000	9,800

NATIVE BUILDING MATERIALS OF THE CANADIAN NORTHWEST.

A Canadian contributor to the Engineering and Mining Journal of New York gives the following information with regard to the native materials available for building purposes in Manitoba and the Northwest Territories :

The artice that comes next in importance in the way of building materials to lumber is lime, which is used largely in plastering and mortar, and where good clean gravel is readily obtained, may, and in the future probably will, be utilized largely in the construction of concrete buildings. Limestone is found in drift to a greater or less extent through Manitoba and the territories. It is found in situ to an unlimited extent near the mouth of the Red River, extending for some miles both east and west of the same. There are also large outcrops on Lakes Manitoba and Winnipegoosis, and the Rocky Mountains in this region may be said to be wholly composed of this material. The writer in preparing this paper does not desire to create the impression that he has endeavored to report all the points at which outcrops of such materials are found ; but is merely mentioning localities where such have come under his own personal observation.

Where limestone is being mentioned as found in situ, good quarries of the rock for building material are readily obtained ; in fact, in very many points are already opened and fairly well developed, and before leaving this branch of the subject it might be well to direct your attention to the probability of very extensive quarries of limestone being developed at the narrows of Lake Manitoba, the rock there lending itself very readily to a smooth finish at a low cost, and it is also alleged that the nature of the formation is such that blocks of large size can be easily quarried.

Both granite and limestone drift rocks may be found nearly everywhere to a greater or lesser extent throughout Manitoba and the Northwest, and, where they are large enough, they can generally be split into any desired shape or size, and even where comparatively small masons can construct buildings not alone substantial, but also ornamental. While on this subject it may be of interest to mention a series of huge granitic rocks which have been deposited, no doubt through the influence of ice, along the foothills of the Rocky Mountains. To convey an idea of the size of some of these, it may be mentioned that one particular boulder located on Section 21, Township 20, Range 1, west of the fifth meridian, shows above ground a bulk of 50 feet in length, 30 feet in width and about 25 feet in height. How large a portion of it is hidden from sight below the ground has never been determined.

Those who have had an opportunity of seeing the bridge piers erected by the Canadian Pacific Railway over the Winnipeg River here have no doubt been struck with the splendid appearance of these specimens of Aberdeen granite, of which they are composed. This material is obtained in the immediate vicinity, and the probabilities are that there is a very large field of this stone which can be had in blocks of any dimension, and there can be no doubt it is susceptible of as high and fine a polish as its original namesake, the "Aberdeen granite," of Scotland, and it will probably in the future take a prominent part in the construction of any works where such material is required.

There is a large outcrop of sandstone in Lake Winnipeg, which is pronounced to be first-class. There are also some sandstones to be found in the vicinity ot Turtle Mountain, the qualities of which, so far as endurance is concerned, would appear to be all that could be desired ; but owing to its color and texture it is doubtful whether it will ever find a market outside of the local consumption, for which, however, it is liable to become very valuable. An outcrop of sandstone may also be seen on the Assiniboine River in the neighborhood of Indian Ford and some stone has been brought to Winnipeg from this point ; but owing to its cost it was not a successful financial venture. It may be useful for local purposes, but probably not beyond that. When the Cypress Hills are reached there are a considerable number of sandstone outcrops and very extensive beds are cross-cut in places by the South Saskatchewan, the Red Deer, the North Saskatchewan, the Bow, the Belly, the St. Mary's, the waterton, and the Old Man's Rivers ; but the finest quality of sandstone is undoubtedly found along the foothills of the Rocky Mountains and the supply there is practically inexhaustible, enough to rebuild all the cities in the world as they exist at the present time. It would seem a great pity that with so much stone in the country our hard-earned cash should be sent across the line to our neighbors for the purchase of stone, as both quality and color is in favor of the domestic article. One is not rash in prophesying that the extensive use of red sandstone will prove anything but pleasing and soothing to the eye if carried to excess.

Vast deposits of this rock are met with in the Rocky Mountains and can be obtained in any size blocks that is required. This material is very well fitted for bridge piers, in fact any structure which is liable to be exposed to the action of water, combined with low temperature.

Where the Canadian Pacific Railway crosses the backbone o the continent there is a large outcrop of slate which gives every promise of becoming a valuable article of good quality as soon as there is demand enough to warrant capital going to the outlay of developing. There is a deposit situated on Kicking Horse River, near its mouth, which was mined or quarried to some extent a few years ago. Some was shipped to the coast, but the action of the moist climate there was too severe for it and disintegration set in. It is, however, more than probable that the same slate, if used in Manitoba or the Northwest Territories, would prove a very good roofing material and withstand the influence of the atmosphere as well as most other roofing slates.

In the Rocky Mountains, along the line of the Canadian Pacific Railway there are to be found very large bulks of quartz carrying copper stains, which are capable of receiving a high polish, and are of a very beautiful color, resembling marble in finish, and would no doubt prove useful and ornamental for the manufacture of table tops, mantels, etc.

The notice announcing to members the first meeting of the Chicago Sketch Club, following vacation, reads as follows : "Members will come prepared to discuss fish stories, summer girls, century runs and similar topics."

Mr. C. E. Sintum, the Canadian Commercial Agent in Norway, reports an increasing trade between that country and the Dominion, and incidentally mentions that he recently gave a considerable order for steam radiators to a Toronto firm.

THE BUILDER

[THIS DEPARTMENT IS DESIGNED TO FURNISH INFORMATION SUITED TO THE REQUIREMENTS OF THE BUILDING TRADES. READERS ARE INVITED TO ASSIST IN MAKING IT AS HELPFUL AS POSSIBLE BY CONTRIBUTING OF THEIR EXPERIENCE, AND BY ASKING FOR PARTICULAR INFORMATION WHICH THEY MAY AT ANY TIME REQUIRE.]

Storm Windows. IT is now time in this northern climate to prepare for the winter, and abundant orders will be placed in the sash and door factories for storm sashes and doors. In order to make storm sashes effective they should be made to cover the whole front of the window frame, and held in place by screws which should pass through the sash stile and grip the casing. This, of couse, cannot be done in a majority of cases, particularly if there are venetian blinds hung to the windows, as it would entail the necessity of taking off the blind trimmings in the fall and putting them on again in the spring, with all the chances of having them mislaid or lost. When the blind trimmings prevent the screwing on of the storm sashes on the outside of the casings, they should be fitted snugly between the casings, and if the sashes are thicker than the casings, which is often the case, the inside of the sash should be rebated over the blind stop, sufficient to admit of the sash dropping into the frame far enough to let the stile be flush on the outside. When this is the case, the storm sashes may be held in place simply by the use of the common Japanned cast iron button which may be obtained at any hardware store for about ten cents a dozen. By making use of these buttons, the labor of placing and removing the storm sashes is made about as light as it is possible to make it, especially if two hardwood dowels be set in the top-rail of the sash, and corresponding holes be made in the head casing to receive the dowels; then, two buttons, one on each side of the frame, will answer for each sash. These buttons should be fixed low down the frame, near the sill, and should be tight enough to prevent any movement of the sash by the action of the wind, and thus prevent the buttons from turning and allowing the sash to get free and fall out of place.

Storm sashes should never be less than 1⅜″ in thickness; indeed it would be much better if they were made 1¾″ thick, as they meet with a good deal of bad usage and wear and tear, in being put up and taken down so often. It is a mistake, also, to make storm sashes with large lights in imitation of the sashes they cover. In the frequent removals, in and out of the window frames, the glass is liable to get broken and more particularly is this the case if the panes are large, and the cost of replacing a large pane is an item worthy of consideration. Small panes cost less if they get broken, and they are not so liable to be broken, owing to their being protected with the mullions and muntins. These mullions and muntins also strengthen the frame and fit it better for the hard usage it has to endure. It goes without saying, that storm sashes of all sorts should be well painted. In the best style of work the sashes get two coats of good paint, composed of white lead and linseed oil, before being glazed; they should also be fitted in place and numbered before being painted, and the edges, top and bottom, as well as sides, should be painted. All the glass should be well bedded in good putty and well held down with a goodly supply of glaziers' zinc points. Much depends on having the glazing well done, for, as storm sashes are more exposed to severe weather than other sashes, special care should be taken when the glass is put in the sash, in order to make it firm and secure. Some painters mix a fair proportion of white lead, moist or dry, as may be needed, with the putty to make it adhere firmly to both glass and wood. This method has its faults, inasmuch as should a pane of glass break, it is next to impossible to break out the putty to make room for the new glass, as the lead and putty becomes as hard as stone.

Storm Doors. STORM doors, like storm sashes, should be made somewhat stronger than the ordinary door, and to this end, when the doors are framed and panelled, they should have all the muntins mortised into the rails sufficiently deep to admit of tenons, not less than 2″ long, which, by the way, should fit snug in the mortise, and white lead should be used as a holder instead of glue. It will be well also if the plough grooves are painted with white lead before the panels are slipped in, as, by doing so, the life of the door will be prolonged from 15 to 25 per cent. The rails should be well fastened into the stiles, and the tenons should be well painted before being driven into the mortises. It is always best to employ three butts in hanging a storm door, the third butt, besides assisting to hold the door, will do much towards preventing it from twisting or warping, a condition that too often occurs in storm doors. All the butts, of course, should have loose joints, as this will enable one to take off the door without taking off the wings of the butts. A very important matter in connection with a storm door is the lock and its furniture. This should be of the very best quality, and should be heavier than the lock on the inner door, while its furniture should be of the same style and finish. In all cases it should be a mortise lock, and should be attached to the door in the most substantial manner. The keeper should extend round the jamb a trifle if possible, in order to protect the jamb or casing from being shattered if the door should be dashed by the wind against it, while the bolt may be shot out, which is sometimes likely to happen. When storm doors are taken down in the spring, they

should be laid carefully away in such a manner as to prevent them from warping, bending or twisting, and put where no water can get at them. The keys should be tied with fine wire to the knobs, and the pins belonging to the loose butts should be fastened to the butts also by a short strand of fine wire. These simple precautions may be the means of preventing much inconvenience and annoyance when it becomes time to again put the doors in service. All of the foregoing relates more particularly to panelled storm doors, but the same hints and suggestions to a large extent, are applicable to the ordinary batten door, with the exception, perhaps, of the locks, for where a batten door is used for a storm door, a thumb latch is generally employed in place of a lock, and where this is the case, it is the better way to get the best thumb latch for the purpose obtainable.

Chimney Building. THERE is no part of a house that requires more care and thought in its construction than the chimney if good results are desired. Yet there is no part in which so little skill, and what may be termed building science, is usually displayed, as in the construction of chimneys. Nothing contributes to the health and comfort of a household in a greater degree than a good chimney, one that will do its duty without having to be forced or doctored. To obtain the best results possible, so far as known at present, the following suggestions should be considered and adopted where the conditions will admit: On no account put a chimney on a flimsy foundation. If, as is sometimes the case, it is necessary to build a chimney from a stand, it should be seen that the plank or timber forming the uprights of the stand, rest on a good solid foundation, and not on the flooring or joists as is frequently done. Many buildings have been destroyed by fire originating between the ceiling joists and roof, because of defective foundations, which have settled, and the brickwork of the chimney shaft having been held in between the joists or roof timbers, has separated at the junction, thus leaving an opening from the flue to the woodwork, which, being dry, was easily ignited by the first spark or flame that found its way through the break. A chimney shaft should never be built so that ledges of brickwork rest on either studding in the walls, joists or roof timbers. This is frequently done, but it is a bad and a dangerous practice. When built from the ground the foundations should be deep enough in the ground to be below the action of frost, and if built so as to form part of an outside or cross wall, it should be well tied or bonded with the stonework of such wall.

When it can be done the flue should be as nearly perpendicular and straight as it is possible to make it, and should be smooth inside, without angles, corners, jogs or contractions, and at no point in its entire length should wood of any kind be near it. Wherever the shaft passes through a floor or a roof, the floor or roof should be "trimmed" around the brickwork, and a space of an inch left clear between the wood and the brickwork; this space can easily be made water-tight in the roof, by proper flashing. If the building should be a frame or a "baloon" one, the brickwork should be kept at least four inches from the outside of the wall. The flue should be "parged" or plastered with a mortar composed of one part fresh cow dung and three parts of ordinary cow dung well mixed and applied the usual way. This mixture should be made as required and used before it has time to set and become hard. A flue so treated will present a smooth glassy surface, hard as a rock, and soot will not accumulate on its sides, while the draft will be much improved. The draft may be further improved by increasing the area of the flue about an inch every ten feet in its height. This increase of area must not be made suddenly or by a jog, but gradually all the way up, from bottom to top. Under no consideration whatever should joists or timbers of any sort, or for any purposes, rest on or in the brickwork of a chimney, for they simply make hidden incendiaries that may some day lead to the destruction of the whole building. An ordinary flue intended for service in a dwelling house where wood or soft coal is used for fuel should contain an area of about 125 square inches, and not less than 96 square inches. If hard coal is used as fuel, the latter number of square inches of area will answer very well. Each fire-place or stove-pipe should have a separate flue, for, if a number of stove-pipes enter the same flue the draft is sure to be defective and troublesome. Wherever it may be necessary to pierce a flue to suit a stove-pipe, the flue should be enlarged at least one-fourth in order to enable it to perform the extra work imposed on it by the addition of another fire.

If a fire-place is connected with the chimney, its hearth should be built independent of the floor timbers, and should rest on brick or stone work and should be filled up nearly level with the floor with concrete, on which hearth tiles or neat cement should be laid to the proper height. In constructing the fire-place care should be taken to contract the throat and keep it well forward, so as to be directly over the fire. In making the contraction, experience has shown that the best system is to start to draw in the brickwork or contract the throat, just at the haunches of the jambs, and make the contraction from both sides, on an angle of 45 degrees, continuing on this angle until the desired flue area is reached, then continue the flue as described in the foregoing. The chimney breast should be made to measure in the room exactly 4 ft. 11 in., so that when a half inch of mortar is applied to both sides by the plasterer, the breast will measure just five feet, which is the regulation size for the width of mantels. The plastering, of course, is rendered on the bare brick work. If a pressed brick mantel is intended to form the fire-place it may vary somewhat from the measurement given, the dimensions, however, may be obtained from the firm from whom the pressed bricks for mantels are to be purchased.

While bricks on edge are permissible for dividing flues from one another, the outside wall of the chimney ought never to be less than six or eight inches thick. A six inch wall may be constructed by laying the outer course of bricks on their flats, and the inner course on their edges and when the courses are all on one plane on top, lay a course of "headers" chopped off to six inches in length, putting the broken end inside the flue as it will act as a bond for the parging. For an 8″ wall the bricks may be laid as headers and stretchers every alternate course. The best hard faced bricks will be used for that portion of the shaft that will be exposed to the weather, and good sound bricks should be used

throughout the whole work. It is advisable to place a soot drainer at the lower end of every flue so that the chimney may be cleared from soot whenever necessary. The foregoing remarks refer exclusively to chimneys built altogether of bricks, but are in a great measure applicable to chimneys built of stone or of adobe. Generally when a chimney is built of stone it is either lined up with bricks or vitrified drain tiles, the latter, when of sufficient area, make the very best flue and are reputed to be the safest as they never gather soot. Adobe chimneys, many of which are found in the remote settlements and on the prairies, should be plastered inside with mortar made as described earlier, and the whole should be left until perfectly dry before any fire is allowed to approach it. Abobes or "dobys" as the westerner calls them, are simply mud bricks, neither more nor less. In dry climates like New Mexico and Arizona and other parts of the southwest they are much used in building, and many of the old forts, mud forts, were built of "dobys," and they have bravely stood the weather for many a long year. In the absence of bricks the Canadian settler often makes use of the "doby" to build the chimney of his log cabin, but he generally mixes cut stone with the mud, and instead of calling his "brick" a "doby" he calls it a "cat." We have never been able to discover the reason why the latter designation was given to the mud brick, but suspect it comes by some round-about way from the Quebec French. Can any of our readers solve the puzzle?

METHODS OF ESTIMATING FOR PAINTERS.

THE use of a reliable system of measurement, which can be laid before the patron, and charging by the piece, or foot or yard, rather than by the "lump," is worthy of general adoption.

In many places the "square" of 100 superficial feet is used. On some work a man can paint six "squares" a day, while on other work he may be able to paint only three squares in the same time. The charges are made to suit these variations, and is preferred by many to the more elaborate, though really more reliable method of applying different prices to different sorts of work. The claim made for the system is that such fixed rules as these, though involving occasional hardships, will obviate the disputes that are likely to arise from differences in the judgments of divers measurers. This system is worthy of noting here, and it is as follows :—

EXTERIOR PAINTING.

1. All plain surfaces are to be measured by their length, multiplied by their breadth. No deduction to be made for ordinary doors and windows. Nor is any addition to be made for scaffolding, staging, etc.

2. On irregular surfaces, such as mouldings, panels, etc., the tape line must follow the contour of the surface, and into depressions, quirks, etc., wherever the brush has properly been.

3. On frame buildings, the thickness of the edges of clapboards, shingles, siding, etc., to be added to the length of the surface.

4. In all cases where the terminal edge is cut in, six inches is to be added to such cutting for each foot in length.

5. In windows and glazed work, when the amount of cutting-in exceeds the surface measurement, the additional cutting-in is to be added to the surface measurement.

6. In shutters, blinds, and other finish containing movable or fixed slats, such slats are to be measured. In trellis work, also, double the measurement.

7. In ornamental work, such as cornices with dentils, medallions, brackets, etc., the parts of the work so ornamented are to be measured as double work and added to the moulded work already measured, as provided in Rule 2.

8. In balustrades, balconies, stairwork having balusters, the opening in which the balusters occurs is to be measured as equal to one-third of the surface for measurement.

9. In ornamental iron cresting, grille work, etc., the surfaces are to be measured and the amount multiplied by three.

10. Picket fences, gates, etc., are to have one-half of their surface measurement added thereto.

INTERIOR PAINTING.

11. Rules for exterior painting apply to interior work as far as practicable.

12. Wood-finishing subject to same rules as painting.

13. In all cases of wall painting the height is to be measured from tip to base or wainscot to the ceiling, and no openings of less than 3 ft. wide are to be deducted. Where the opening is from 3 ft. to 6 ft. wide, one-half of its contents are to be deducted, but one-sixth in width is to be added for each side of the openings, its entire length.

14. In calcimining or wall tinting, the walls and ceilings treated are to be measured over all, and no deductions for openings to be made. The same rule to apply to white-washing.

15. In all cases of wall painting or calcimining where plaster cornices are painted or tinted, the girth of the cornice to be measured double and added to the wall surface. Where ornament is painted in such cornices, etc., the provisions of Rule 7 are to be observed.

16. All striped work and stencilled border or frieze work must be measured by the lineal foot.

17. No carved work, plaster centres and ornamentation, foliated capital of columns, statuary, etc., are subject to measurement, but are to be charged for by the piece.

18. Painting finished in more than one color, measurements as for plain painting. The extra cost to be in the price charged for the work, but all striping in gold or colors to be measured by the lineal foot.

19. In measuring beaded ceiling or wainscot, or other work in which sunken beads are found, for each bead not more than 1½ in. wide, add 1 in. to the length of surface measured.

20. In all floors, hardwood or otherwise, all wainscot, base, surbase, picture moulding, etc., in which the paint or wood-finish is required to be cut in, at its terminal edge, the provisions of Rule 4 are to be observed.

As already stated and shown, there are various methods of getting at one and the same purpose. Take measurement of a surbase, and one way is to take actual measure and add four inches for cutting in at top and bottom. Another way is to take lineal measure, and if the base is ten inches wide, call it a foot, because painting the extra two inches is not considerable, and when you come to a fourteen inch base, you call it still a foot. And thus the matter is equalised. In the latter way nothing is added for cutting-in at top and bottom, and this avoids disputes with customers, who may not see the justice of charging for cutting-in.

Other conditions enter into the problem of measuring work that still further embarass the measurer. The work may be new or old, and in various stages of newness and decay. New work differs much in the manner of its preparation for painting, and an old job may be easier to repaint than a certain new job. The proper way to provide for this would be to have a separate schedule for each class of work. Thus new and old work might be divided into class A, best condition for painting; class B, fair condition; class C, poor condition; class D, bad condition. This would be put under proper heads, as "new work," "old work." Removing old paint by burning it off should be noticed under its proper heading, or removing by alkalies or any similar treatment. It is worth 30 cents a square yard to burn off paint from a plain surface.

In measuring balusters it is very difficult to lay down a fixed rule of measurement. The rule is to allow double measurement for square balusters, and treble for round. Say a row of balusters is 12 ft. long and 3 ft. high, including a rail on top. The tape line is run over the rail from one side to the other, giving 6 ft. This being doubled gives 12 ft., and multiply the length, 12 ft., by this height of double 6 ft., or 12 ft., gives a total of 144 ft. The turned baluster would give 216 ft. Balusters, of course, differ in style, and hence much must depend upon the judgment in measuring. Again, take window blinds, or Venetian shutters. If these are large the profit of painting them by the square yard will be large, while doing small blinds the same way will hardly pay, especially at the hands of a slow workman. Some painters, in measuring the front of a house, say, estimate the job "solid," taking no account of windows. Others count windows separately. It certainly takes longer to paint a building that has many windows than one having but few, and unless some separate account is made it is hard to say how a correct estimate can be made. In doing roofs that have turned up seams, say an inch high, it is proper to add two inches for each seam the roof contains. Estimating gable ends, peak roofs, and the like, some halve the distance from the square of the building to the apex of the roof, and count same as below the square. Others, again, taking into account the trouble involved in doing such work, count the work as square.

Other elements affecting cost of doing work consist in such matters as number of colors; number of coats; tints to match certain objects, as wallpaper, carpets, etc.; graining, its quality; varnishing, quality of varnish. The work on a fine house will necessarily cost more to do than that on a cheap house, and these matters can be arranged under the headings suggested and relating to new and old work of various conditions of finish. It is not difficult to lay down fixed rules that will apply to the great bulk of the work done, but the exceptions are the trouble. Graining may be classed as first, second and third quality, or fine, good and "knock-off," as some grainers call quick, cheap work. There can scarcely be any room for other character of work between these classifications.

Having set a standard price on such work, say two shillings per yard, then for first-class work add 25 per cent., and for third-class or cheapest work deduct 25 per cent. This is a sort of sliding scale, and might be made to apply to painting as well.

Painters ought not to guess at the cost, nor take the architect's figures for it. Nor should they conclude that because a certain similar job cost so much to do, this particular job will cost about the same. Estimate too high, and the job is lost. Too low, and money is lost. There is a certain arrangement among some of the master painters in the States whereby incorrect estimating is somewhat obviated. An association is formed, and when a member makes a bid or tender for a job, he lays his figures before the association, as does any other member estimating on the same work. An average is made of these bids or tenders, the man nearest that average getting the work, or if not near enough, his price is raised to the average, and the others withdraw from the contest. But they are not absolute losers. Indeed, the low bidder is the gainer, because he is sure of receiving a certain percentage of the amount of the successful man's contract price, whereas had he secured the work at his own figure, he would doubtless have had his work for nothing. This plan works very well. It nullifies the evils of competitive bidding, and even those who fail to get the work get a percentage of that work's profits. And when the owner of the work understands this scheme he likes it, too, because he knows that he is getting his work done at a fair price.

THE FOUNDATIONS OF THE NEW YORK CATHEDRAL.

On a commanding eminence in the outskirts of the Morningside Park, New York City, work has been progressing for some months upon the foundations for a costly and imposing cathedral, which is designed to be one of the largest and finest, if not the most beautiful and important of modern ecclesiastical structures. Its site is on the crest of a bluff overlooking a large part of upper New York and the Hudson river. It lies between Morningside Drive and Amsterdam Avenue, and extends from One Hundred and Tenth to One Hundred and Thirteenth Streets, affording ample area for the display of its architectural beauties, while the handsome buildings of Columbia College and of St. Luke's great hospital adjacent will be consistent environment. The finished building will be about 520 feet by 290 feet in extreme dimensions, about as large as St. Paul's in London, and will have a grand tower about 445 feet high. At present the construction is begun only upon a small part of the edifice, viz., upon the tower and its adjacent choir, for which the foundations are now well advanced.

As the rock outcropped in places at the site, it was believed that solid and most satisfactory foundations could be very easily secured, but when excavation and levelling was begun it developed a singular and troublesome condition of affairs, which has necessitated much delay and expense. The stone, the familiar gneiss of the locality, was disposed in very irregular masses, the formation of which was almost like waves, the surfaces of the outcropping ledges sloping down in places at a sharp angle and intersecting at the vortex of troughs 20 to 45 feet below the surface. At other places the surface of the solid rock was not so deep, but was very irregular, and much of the upper part of the stone was found loose and disintegrated or filled with pockets of earth and clay, so that considerable excavation was necessary to secure an enduring and reliable platform on which to impose the heavy and extensive loads of the enduring structure.

It was, therefore, determined to excavate several large pits which should each contain the piers for sev-

eral adjacent important foundations. The earth and loose and unsound rock were all removed, and the solid rock faces exposed roughly dressed and scrupulously cleaned with wire brushes, then thoroughly washed with hose and brooms and the space filled up to elevation 112 (an average depth of 15 feet and a maximum depth of 45 feet) with a uniform mass of concrete, upon the level surface of which the cut granite pier footings are laid. The surface is nearly continuous, interrupted only by some recesses where the distances between pier footings were largest, and to leave canal-like passages about 12 feet deep for pipes, etc., although up to elevation 100 feet no openings at all were left in the concrete laid. The great tower itself rests on arches sprung high in air from four smaller corner towers with flying buttresses. Each of these four towers transmits an estimated pressure of 17,000 tons to the bed of concrete which supports its base, 38 feet square, thus producing a load of about ten tons per square foot. To distribute this and proportionate load from the rest of the structure, great pains have been taken to secure a solid and homogeneous bed. To this end the concrete, which is composed of cement, sharp sand and gravel in proportions of 1, 2 and 3 respectively, was thoroughly mixed quite dry and rammed by 20-pound rammers from 10-inch horizontal layers to 8-inch thick layers, and till the water was flooded to the surface. When night came the layers were terminated wherever it happened with long sloping edges, and when work was resumed in the morning the whole top surface was plastered with a mortar made 1 cement and 2 sand, upon which the next course of concrete was laid and rammed exactly as if setting blocks of stone. The concrete became very hard over night, and this method is believed to have secured a real monolithic condition throughout the whole mass of concrete, which now contains about 11,000 cubic yards, and will require about 2,000 yards more to complete it.

Quartz gravel, 1½ to 2 inches large, and sharp sand, both from Port Eaton, on the north shore of Long Island, are used for the concrete, which is mixed of such consistency as to be just capable of moulding into a ball in the hands. The cement (17,000 barrels of which has been used so far) is Aalborg's, Alsens, Germania, Mannheimer and Silica-Portland. The latter is used almost exclusively for masonry mortar. The cement is stored in two large houses on the site. A sample of cement taken at random from one barrel in every ten is tested on a Riehle 1,000 lbs. machine by the engineer's inspector in a laboratory equipped at the site. Here about 600 briquettes are kept hardening under water for one, seven and twenty-eight day tests. Very little of the cement has had to be rejected, much of it with three parts of sand developing a tensile strength of over 200 lbs. in seven days. The usual tests of fineness and rapidity of setting are performed with customary standard apparatus.

The foundations will contain about 5,000 yards of dimensioned granite masonry. The concrete work is notable for its unusual magnitude, the manner in which it is executed, and for the character, arrangement and operation of the plant for making and handling it. All material is carted to the site and delivered directly to the derricks, to the storehouses, to the working platforms, or is distributed by the central track. All the concrete is mixed in two standard Sooysmith machines, set on opposite sides of the work so as to deliver their product close to the place where it is required. Each mixer is set with the top of its hopper about level with a working platform that closely surrounds it at the surface of the surrounding ground, and upon which materials are delivered by wheelbarrow and derrick and placed in bins. Men with shovels keep it continuously fed into shoots that carry it down to a platform about 6 feet below, upon which rest the lower ends of three inclined chain and bucket conveyor elevators that are driven at the same speed, about 2 feet per second, by a small vertical engine on the same platform. This engine also drives the mixer. All are driven by belts, which will slip and allow the machinery to stop when obstructed rather than break as a gear would. One elevator is encased throughout in a tight wooden case, the lower part of which is filled with loose cement, which it brings up and empties into the upper part of the mixer hopper. The next elevator is on the opposite side of the hopper, a couple of feet nearer the discharge end, and delivers sand from a heap at the foot of the chute below, where two men are constantly in attendance to see that each bucket is level full. The third elevator is 2 feet further away, on the same side as the cement elevator, and similarly served by two men, and delivers gravel. The mixer is about 12 feet long over all, and inclined about 1 in 12 down towards the discharge end. Its shaft makes about 20 revolutions per minute, and is fitted with about sixty inclined bevelled radial cast-iron arms that mix the materials very thoroughly, even before they are wet by a man with a hose-nozzle just opposite the gravel elevator, and considerably more afterwards. The elevator buckets each hold about 1 cubic foot and discharge their contents over to the further side of the shaft. They are set at distances apart on their chains inversely corresponding to the proportionate quantities of material they are to furnish for the concrete. Below the mouth of the mixer is a third and still lower platform, upon which are two short 30-inch gauge tracks, about 4 feet apart centre to centre, each with one car upon it. A car upon one of these tracks is run up under the mouth of the mixer and a little to one side of its axis, but parallel with it, and the mixer delivers continuously into its 1-yard iron bucket (which it can fill heaping full in a minimum time of about two minutes) by a flat wooden chute about 4 feet wide and 6 feet long, mounted on a horizontal axis just below the mixer and in a vertical plane through its own axis. This chute is operated like a butterfly valve, first tipped up to an angle of 45 degrees with the vertical on one side, so as to divert the flow from the mixer all into the bucket on the right-hand car. When that is nearly filled a bucket and car are pushed up on the left-hand track. The top of the chute is revolved 90 degrees to the right, and the discharge from the mixer is instantly diverted into the empty car, and the full one is run off and taken by the derrick, which can usually swing it to the required place and empty it immediately. Sometimes hauling and the delay of materials threaten to hinder the work, and such occasions are taken to lay concrete most remote from the mixers that takes more time or the use of two derricks to handle it. When the concrete has set it is kept constantly well sprinkled for several days.

About twenty men are required in direct attendance upon each concrete mixer, and about forty-five more are required for all the concrete work, tamping, wheeling, hoisting engines, etc., for each machine's maximum

product. As high as 260 men a day have been employed on this contract, the active prosecution of which was begun on April 1. The highest output of one concrete mixer has been 262 yards of tamped concrete, or 328 heaped 1-yard buckets of loose concrete in 8½ hours. Vertical faces of concrete are obtained where necessary by 1-inch mould boards secured to well-braced studs outside.

The principal plant consists of the two concrete mixers, driven by two 15 horse-power vertical high-speed engines, a Murray and a Safety; two horizontal tubular water bottom 50 horse-power Lidgerwood boilers, one Cameron duplex steam pump with 3-inch suction, which has been needed only to remove the rain-water, one derrick, 70-feet mast and 65-feet boom, all with four steel rope guys and running tackle, good for 10 tons load each. Two of them have the Buffalo standard fittings and the remainder those of the St. Paul Hoist and Derrick Company, and all of them have new round sticks of Norway pine spars from Brooklyn yards. They are all painted white, and present a neat and handsome appearance. They are operated by six double-drum Lidgerwood hoisting engines, two of them with individual boilers. Messrs. Heins & LaFarge are the architects, and Gen. William Sooy Smith, of Chicago, is consulting engineer of the cathedral, and the above-described work is being executed by Sooysmith & Co., contracting engineers, of New York, upon a commission contract. The earth and rock excavation was done by J. D. Crimmins and J. J. Hooper respectively, and John Pierce has a contract for dimension granite for piers, etc.—Builders' Reporter.

UPRIGHTING A TALL BRICK STACK.

UNDER the above heading Brick describes the method by which Mr. E. W. Seamans, of Grand Rapids, Mich., succeeded in righting, at the Standard Concrete Manufacturing Works, at Norristown, Pa., a tall chimney that had declined considerably from the perpendicular:—

At the company's works there is a brick smokestack 122 feet high and 11 feet square at the base, the walls are 36 inches thick and the whole structure weighs not less than 400 tons. Some time since the top of the stack began to lean over and, when it inclined 45 inches from a vertical line, it was felt to be too dangerous to allow to go any further.

It was agreed that any attempt to pull it back to a perpendicular position would certainly cause its destruction. Contractors would not undertake the task of righting it for any less sum than the cost of pulling down and rebuilding it. So Mr. Seamans thought out an entirely original scheme for straightening it; this he had to carry out himself, as no one would take the risk.

To raise the sunken side of the stack was an impossibility. The only course left, therefore, was to sink the other side four and one-half inches. To accomplish this ten and one-half inches of brick work was removed from the foundation on three sides. As the bricks were removed square blocks of wood were inserted, one after the other, until three sides of the towering mass of bricks rested on wooden cubes. Between the blocks supporting the stack temporarily substantial brick piers six inches high were built, leaving a space of four and one-half inches between the top of the piers and the bottom of the undermined brick-work.

The foundation was now in readiness for the culminating feat, the removal of the wooden cubes, which, successfully effected, the side of the stack would be lowered to the piers prepared for supporting it while the interstices were bricked in. The blocks had to be removed gradually and simultaneously.

Each block was ignited and all were kept burning briskly. If one burned faster than the others the fire on that particular block was quenched until the others reached the same stage of incineration. Thus all were made to burn uniformly, and as the blocks were being reduced to ashes the stack slowly righted, until the last ember died out, when its top was on a vertical line with the base.

The entire work consumed one day. The reduction of the wooden blocks to ashes required an hour. In that time the top of the stack moved forty-five inches, but so slowly that men with powerful field glasses could not detect the slightest motion.

PERSONAL.

Mr. A. M. Ross, senior member of the firm of Ross Bros., painters, Hamilton, Ont., is dead. He was born in that city in the year 1838, and worked for a number of years in the car shops of the Great Western Railway. After the death of his father he took charge of his business, and conducted it with his brother.

There is much anxiety on the part of the friends of the Hon. Mr. Harty, Minister of Public Works for Ontario, owing to the conflicting reports regarding the condition of his health. It is hoped, however, that he may be successful in his effort to regain health, and be able in the near future to again resume the active duties of his Department.

Mr. A. M. Calderon, the well-known architect of Ottawa, has taken unto himself a bride, in the person of Miss May Bate, daughter of Mr. Newell Bate, merchant of the same city. The wedding took place on the 23rd of October, at Christ Church, the venerable Archdeacon Lander officiating. Mr. and Mrs. Calderon left on a short tour in the States.

The death occurred at Victoria, B. C., last month of Mr. William Wilson, at the advanced age of 94 years. Deceased was born in Banff, Scotland, where he learned the mason's trade, coming to Canada at the age of 29 years and settling in the city of Quebec. For upwards of half a century he carried on business as a builder and contractor, and erected a number of important buildings in that province.

At St. John's church, Toronto, on the 6th of October, Mr. Frank S. Baker, of the firm of Curry & Baker, architects, was united in marriage to Miss Florence Mary Kenrick. The ceremony was performed by the Rector of the church, the Rev. A. Williams, in the presence of a large assembly. Mr. Baker and his bride are spending their honeymoon in the Eastern States. We join our congratulations to those of their numerous friends, and wish them a happy and prosperous voyage through life.

On the 22nd ultimo the death occurred in Toronto, after a lingering illness, of Senator John Ferguson, M. D. Deceased was born in the county of Middlesex, Ont., in 1839, and was at one time a prominent contractor. He built a portion of the New York and Oswego Midland Railway, and the Galt and Berlin road was also constructed under his supervision. He was given the contract for the enlargement of six miles of the Welland canal, and, with Mr. Robert Mitchell, built the larger portion of the waterworks system in Toronto and also the works at St. Catharines.

Every poor speller seems to finally go into the sign-painting business.—Atchison Globe.

A striking instance of the durability of timber, under certain conditions, was afforded during the excavation for the foundation of the Bowling Green Building, New York. A line of spruce piles was discovered at some distance below the surface of the ground, which, as far as we can learn, were placed in position about 150 years ago and actually formed a bulkhead, the tide then reaching this point. These piles, upon examination, were found to be perfectly sound, and to all appearances would have been just as sound and good 150 years hence.

In his selection of typical workmen Mr. Gladstone has given preference to those in the building trade. The editor of the British Workman having asked Mr. Gladstone for a message to working men which is to be reproduced in fac simile in that ournal, has received one, of which the following is the most interesting paragraph: "I think there is among parents in what are called the laboring classes too much anxiety to take their children out of hand labor and to transfer them to head labor. But a good deal of what is called head labor is not worthy of the name, whereas hand labor is, in many branches, capable of great elevation. Take, for example, the connection of the mason's trade with the sculptor's art, and the relation between the carpenter and the wood-carver. Further, the higher hand labor is very much better paid than the lower head labor. It would be of great utility to laboring men if they would think this through for themselves."